News about

B.F.Goodrich Chemical *raw materials*

name your problem...

HYCAR CAN SOLVE IT!

IF THIS IS YOUR PROBLEM:

HERE'S THE ANSWER:

You manufacture shoe soles, floor tiling or similar semi-hard products that demand "leather-like" rubber compounds. Hycar 2007, a high styrene copolymer in resin form, fills the bill. Easy to use, this material makes high quality rubber compounds in any range of hardness.

Hycar 2007

You need an excellent non-migrating, non-volatile, non-extractible plasticizer for rubber and plastic compounds. The answer is Hycar 1312, a *liquid* nitrile polymer. It can also be cured to hard rubber stage without requiring costly processing equipment.

Hycar 1312

Or you must have a modifying agent that improves the smoothness of extrusions and calendered goods. Hycar 1411, a high acrylonitrile copolymer, is specially designed to blend easily with other Hycar rubbers to achieve this quality.

Hycar 1411

You make working parts for the oil, automotive and aircraft industry that must stand up to air and hot oil at temperatures above 300°F. Hycar 4021, an acrylic ester copolymer, extends the useful temperature range of rubber to 350°F for continuous and 500°F for intermittent service.

Hycar 4021

You make chemically blown GR-S sponge and want to simplify compounding and cut costs. A *liquid* GR-S polymer, Hycar 2000X68, has been developed to meet these requirements. It can be easily, economically blended with standard GR-S for use in applications now being served by GR-S 1010.

Hycar 2000 x 68

These are only a few examples of the wide ranges of Hycar American Rubbers that are tailored to meet specific requirements. For copies of available literature listing the properties of standard materials, write Dept. EP-11, B. F. Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable Address: Goodchemco. In Canada: Kitchener, Ontario.

Hycar
American Rubber

B.F.Goodrich Chemical Company
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B.F.Goodrich **GEON polyvinyl materials • HYCAR American rubber and latex • GOOD-RITE chemicals and plasticizers • HARMON colors**

PHILBLACK*E takes top honors for longer-wearing tires!

Tires on trucks and heavy duty equipment take a terrific beating . . . hauling heavy loads over bad roads . . . and under extremes of heat and cold.

Philblack E, the toughest of all the Philblacks, adds thousands of miles to tire life because treads made with Philblack E stand up better under abrasion. And this long-wearing black enables rubber to stand more bending and flexing, too. For extra tough jobs, you can't beat Philblack E.

There's a Philblack to suit every purpose. The correct Philblack will give rubber the specific characteristics you need in your particular product. Consult your Philblack technical representative to learn how the Philblacks can help you.

*A trademark

Meet the Philblacks!

DISCOVER WHAT THEY'LL DO FOR YOU!

A — **Philblack A FEF Fast Extrusion Furnace Black**
Ideal for smooth tubing, accurate molding, satiny finish. Mixes easily. High, hot tensile. Disperses heat. Non-staining.

I — **Philblack I ISAF Intermediate Super Abrasion Furnace Black**
Superior abrasion resistance at moderate cost. Very high resistance to cuts and cracks. More tread miles at high speeds.

O — **Philblack O HAF High Abrasion Furnace Black**
For long, durable life. Good electrical conductivity. Excellent flex. Fine dispersion.

E — **Philblack E SAF Super Abrasion Furnace Black**
Toughest black on the market. Extreme abrasion resistance. Withstands aging, cracking, cutting and chipping.

Phillips 66

PHILLIPS CHEMICAL COMPANY, Rubber Chemicals Division, 318 Water St., Akron 8, Ohio. Export Sales: 80 Broadway, New York 5, N. Y.
West Coast: Harwick Standard Chemical Company, Los Angeles, California.

NEW

PLASTOLEIN® 9404 TGP

a superior
synthetic rubber plasticizer

at lower cost!

New Plastolein 9404 TGP (triethylene glycol dipelargonate) offers superior performance in synthetic rubbers. Yet it *costs less* than commonly used low-temperature plasticizers.

For example, as compared to other more expensive glycol-type esters and adipate plasticizers, 9404 gives lower heat loss, lower compression set, less water sensitivity and equivalent low-temperature flexibility.

In addition, since Plastolein 9404 is produced in accurately controlled equipment from easily obtainable domestic raw materials, high quality standards are maintained and continuing availability assured.

For detailed information on Plastolein 9404 TGP, mail coupon, or write for an evaluation sample.

Emery

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Emery Industries Inc.
Dept. U-11, Carew Tower, Cincinnati 2, Ohio

Please send me bulletin on Plastolein 9404 TGP.

Name.....*Title*.....

Company.....

Address.....

City.....*State*.....

NEW KIND OF FEED BAG is this big "pillow tank" of nylon fabric coated with CHEMIGUM. It holds 10,000 gallons of volatile fuel, yet can be carried in a small chest, rolled out like a rug, filled in minutes—anywhere.

"SUB" THAT'S NOW FIRST STRING is this basketball with cover of PLIOFLEX reinforced by PLIOLITE S-6B. It looks, feels, acts like leather, but is much more wear-, water- and scuff-resistant—lower in cost.

How to get the most out of rubber

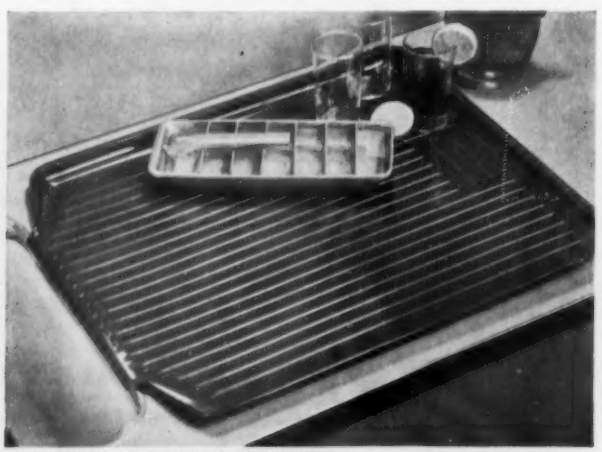
Each of the products pictured here has successfully met the test of today's competitive market. But there's no secret to this success. It stems from the simple fact that their manufacturers availed themselves of the new materials and services offered by the newly formed Rubber & Rubber Chemicals Department of the Goodyear Chemical Division.

The materials offered include two families of general-purpose styrene-butadiene polymers—PLIOFLEX Rubbers and PLIOLITE Rubber Latices. For oil-resistant applications, the CHEMIGUM Rubbers offer a range in both nitrile content and properties. For rubber reinforcement, there's PLIOLITE S-6B, a high-styrene resin. In non-staining antioxidants, WING-STAY S is the first of a line of job-designed rubber chemicals.

"Job-designed" aptly describes all of the materials supplied by the Rubber & Rubber Chemicals Department. As a matter of policy, they all were specifically developed to meet specific needs. And since proper application is essential to their advantageous use, it is also a matter of policy that their sale be accompanied by complete technical service.

Recognition of the need for thorough technical service was the basic reason for establishing the

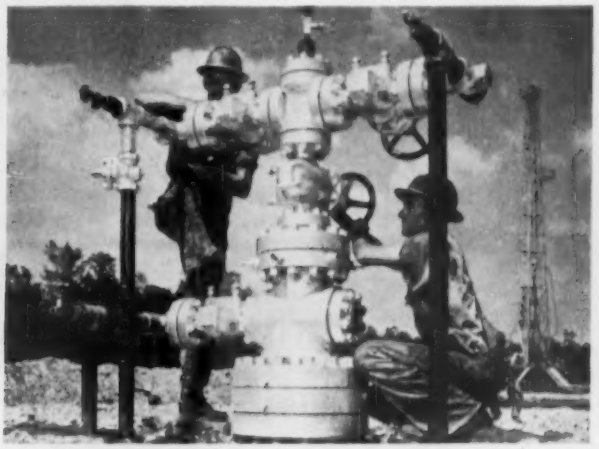
COLORFUL COASTERS that stay bright and flexible are made of foamed PLIOLITE LATEX protected with WING-STAY S. They keep their "just bought" look and absorbency despite exposure to water, sunlight or repeated washings.



CHEERFUL HELPERS AROUND THE HOME are mats, strainers and other housewares of styrene rubber reinforced with PLIOLITE S-6B. The resin imparts toughness, rigidity and smoothness—adds to wear-, oil- and water-resistance.

ACID TEST IS TAKEN AND PASSED—every day in many ways—by strong, safe, easy-handled hose made of PLIOFLEX reinforced with fabric and, sometimes, steel wire. It's a flexible answer to many materials handling problems.

SOMETHING NEW UNDER THE CHRISTMAS TREE at many oil wells is an oil-resistant shoe sole consisting of CHEMIGUM blended with PLIOFLEX. This blend provides excellent combined wearing and oil-resistant properties at low cost.



in eight different ways

Rubber & Rubber Chemicals Department. Its formation permitted the marshaling of the skills and experience of many technicians, plus the proper physical facilities to help you get the most out of rubber as easily and economically as possible.

Why not learn firsthand how the products and services of the Rubber & Rubber Chemicals Department can put your product in the same class with the eight shown here? It's easily done by writing to: Goodyear, Chemical Division, Dept. W-9419 Akron 16, Ohio.

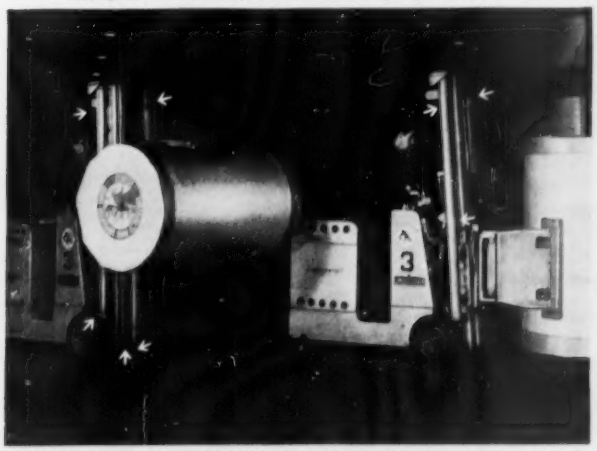
RUBBER & RUBBER CHEMICALS DEPARTMENT

CHEMICAL GOODYEAR DIVISION

CHEMIGUM • PLIOFLEX • PLIOLITE • PLIO-TUF • PLIOVIC • WING-CHEMICALS

High Polymer Resins, Rubbers, Latices and Related Chemicals for the Process Industries

Chemigum, Plioflex, Pliolite, Plio-Tuf, Pliovic, Wing-Stay—T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio



PUTTING THE LIFT IN LIFT TRUCKS calls for tough, oil-resistant rings and seals in hoist and tilt rams. CHEMIGUM plus PLIOLITE S-6B gives the hardness, smoothness, strength and dimensional stability required.

LASTING ELASTICITY, STRENGTH AND SOFTNESS are essential in surgeons' gloves. Heat- and water-resistant WING-STAY S does much to help the natural rubber retain its original properties, despite repeated sterilization.

• a highly reinforcing white pigment

• excellent resistance to scorch

• good dispersing characteristics

ZEOLEX* 23

*Microlitic Zeolite

PHYSICAL PROPERTIES:

pH (20% water slurry)	10-11
Form	Dry Powder
Handling Precautions	None (non-toxic)
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Screen Residue (325 mesh)	0.1% Maximum
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COVERING THE MANUFACTURE OF RUBBER AND RUBBERLIKE PLASTICS PRODUCTS

Published Monthly by
PALMERTON PUBLISHING CO., INC.
Editorial and Advertising Offices
101 West 31st St.,
New York 1, N. Y.
PEnnsylvania 6-6872

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This comprehensive treatment, replete with tables and charts, considers the effects of adding silicone oils to conventional rubber compounds. The nature and stability of the oriented "silicone bridge" between filler particles and organic materials, and product qualities to be expected from these intermolecular and inter-surface phenomena, are discussed.

The Reaction of Molecular Oxygen with Rubber—*By E. M. Bevilacqua* 271

The discussion concerns what may be called the organic chemistry of the cutting process, that is, the series of steps leading to what is observed macroscopically as the effect of scission. It is restricted to natural rubber since it is the rubber which has been studied the most and is the only one for which some idea is had of the molecular processes occurring.

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Letters to the editor

Still More on Tubeless

Dear Sir:

The letter concerning "Tubeless Versus Tubes" appearing in your July, 1956, issue of RUBBER AGE, leaves us with the impression that the writer either pointed his questions or gathered his information right at the very beginning of the use of tubeless tires when very little was known about them by the general public.

His specific objections to the use of tubeless tires are as follows:

1. Fail to hold air.
2. Collapse on short turns.
3. Repairs not possible by average garage.
4. Blow on sidewall of tire will cause collapse.

We would like to discuss each of these in turn.

1. *Failure to hold air:* Failure to hold air is an adjustable condition. We have been producing tubeless tires in very large quantities for better than two years. The number of tires that have come back because of failure to hold air is so very, very, small that the problem doesn't exist in regard to tubeless tires.

2. *Collapse on short turns:* Both tube-type and tubeless tires may collapse if the car is wrecked. In other words, forces developed in wrecking an automobile are sufficient to break anything on the car, including the wheels or dismounting the tires. Our experience is that where such claims have been made the car has been completely out of control when the accident happened, both with tube-type and tubeless tires.

3. *Repairs not possible by average garage:* Repairing of tubeless tires is not at all complicated and, as a matter of fact, punctures in that type of repair are handled much easier than on tube-type tires without even having to dismount the tire. This has been common knowledge for some time and we believe you will find most tire agencies have no difficulty with repairing tubeless tires.

4. *Blow on sidewall of tire will cause collapse:* The only blow on the sidewall of a tire that will cause collapse would have to be on the flange of the rim itself rather than on the tire. In other words, if you would bend the rim sufficiently to knock the tire bead completely off the seat, it would then become deflated. A blow on the sidewall of the tire itself will not unseat the tire.

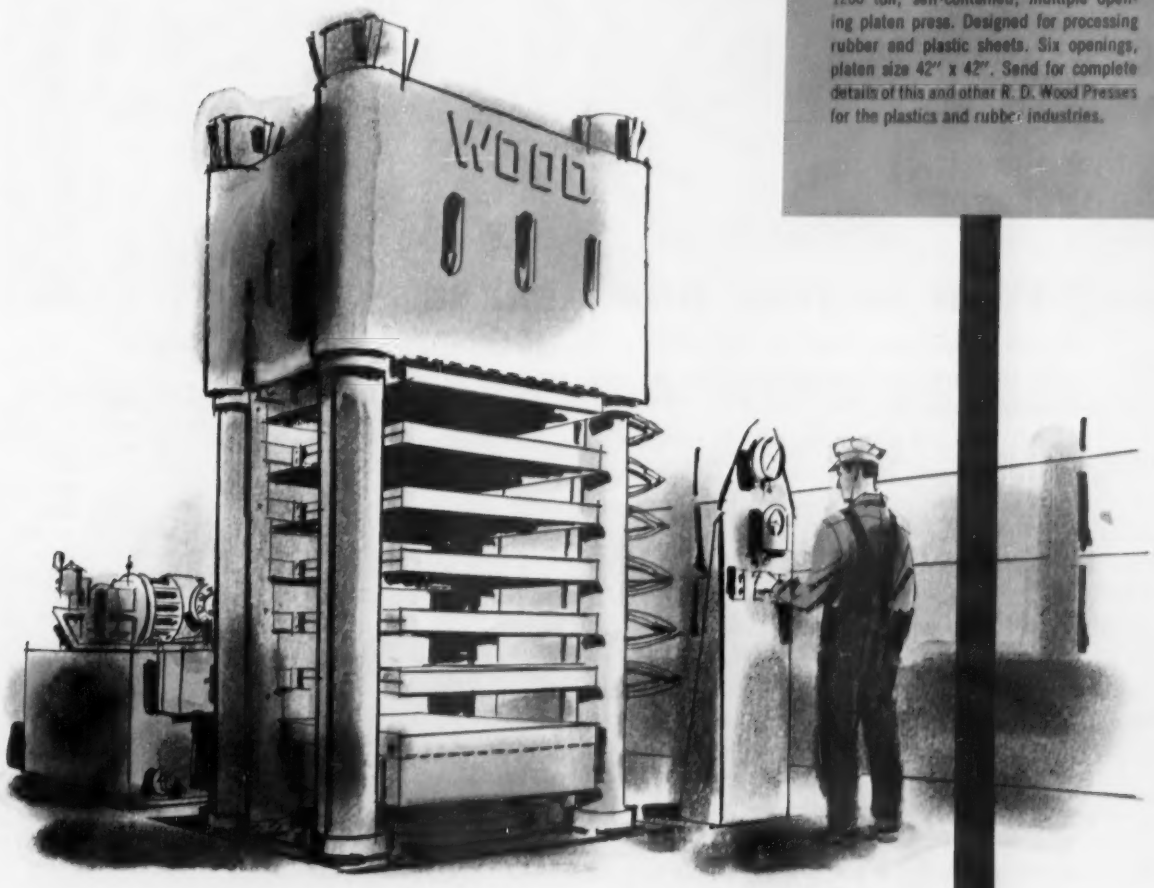
In commenting on the latter as a whole, it is our contention that the criticisms made can apply to the same limited extent to both tube-type and tubeless tires. Furthermore, we believe that had the original standard tire been tubeless, and the industry for some reason changed to tube-type, the same person would have written a letter to you, probably making the same criticisms.

I hope you will not consider this reply too sharp, but we do find that too many

There's always a job for a Wood Press... and a Wood Press to do the job

When you want a production shortcut—or downtime and costs need cutting—there's a job for a Wood Press. And in almost every type of plastics or rubber operation, there's a Wood Press to do the job. R. D. Wood builds presses for such jobs as molding, curing, laminating, polishing and processing—besides designing and constructing others for special work. All have three things in common: sound design, carefully selected materials, conscientious workmanship. As a result, R. D. Wood Presses consistently deliver the utmost in smooth, dependable performance; fast, economical production; trouble-free operation. Write for catalog and engineering information—without obligation.

1200 ton, self-contained, multiple opening platen press. Designed for processing rubber and plastic sheets. Six openings, platen size 42" x 42". Send for complete details of this and other R. D. Wood Presses for the plastics and rubber industries.



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In recent field tests this new Day Mixer produced a superior mix in only 15 minutes, as compared to 35 minutes, required by a Day Single Motion Mixer.

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For complete information write for Bulletin I-502-PM.

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people are inclined to consider a little early trouble as the ultimate to be expected and overlook the steady improvement made in the past two years.

W. E. SHIVELY
Manager Engineering,
Tire Development,
Goodyear Tire & Rubber Co., Inc.,
Akron, Ohio

In Agreement

Dear Sir:

I am fully in agreement with the sentiments expressed by your recent correspondent (RA, October, 1956) with reference to papers presented before the Rubber Division, A.C.S. Prominent educators tell us that the lecture is perhaps the poorest way to instruct.

It would be to the benefit of all concerned if, in the future, papers to be presented before any technical group were preprinted and made available to interested parties before the actual meeting. In this way, members would have an opportunity to read and to digest the contents and to formulate those questions which might arise. The author could then present a brief synopsis of his paper and give the major portion of his time to the answering of questions from the floor.

To be sure, there are financial problems involved in the preprinting of papers and suggestions on this score might well be considered by the industry.

NAME WITHHELD

Some Help Needed

Dear Sir:

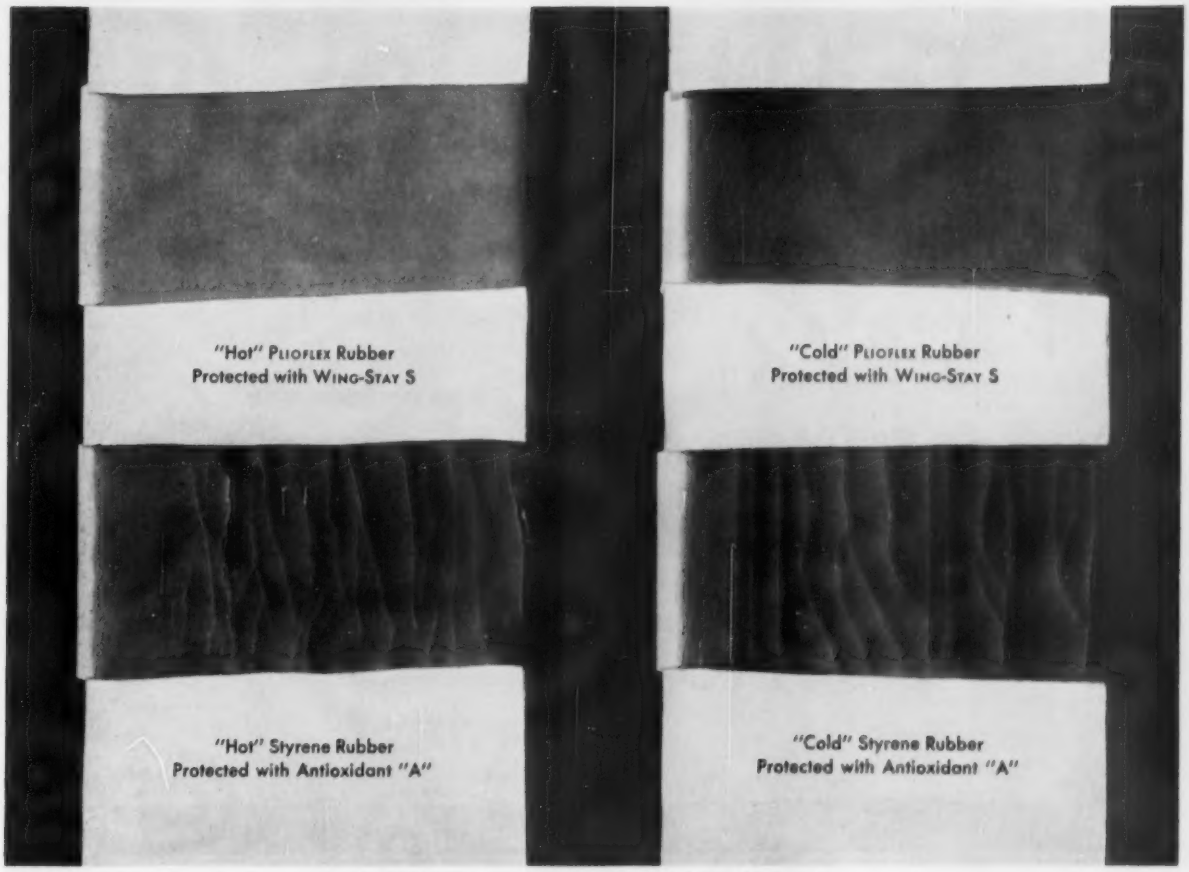
We are presently planning the manufacture of a small hard rubber article and in this connection we are wondering if you will be so kind and let us have the name of manufacturers who could supply us with a compound for making hard rubber. We also would like to contact a company that will sell us a vulcanizing machine such as the dental mechanics use.

E. G. MEYER
Meyer Bros.
Northport, N. Y.

. . . . . We are manufacturers of latex products and are interested in securing literature and prices on all kinds of machinery for latex dipping purposes. Will you please give us the names and addresses of such manufacturers since we are interested in purchasing some new and modern machinery necessary for our production. Your cooperation will be appreciated.

ROCCHI CARLO
Via Bassano Del Grappa 19
Milano, Italy

We invite comments for publication in these columns. Address the Editor, RUBBER AGE, 101 West 31st St., New York 1, N. Y.



NOTE: All samples exposed to direct sunlight for three weeks

How to stop the sun in its attack on rubber

Exposure to sunlight can result in premature surface hardening and cracking of both natural and synthetic rubber goods. But *not* if you use WING-STAY S—the outstanding, nonstaining, non-discoloring antioxidant on today's market.

WING-STAY S is a liquid styrenated phenol. Easily incorporated into dry rubber or latices, it is extremely resistant to heat, sunlight or extraction by water—provides economical protection against aging with a minimum of discoloration, odor or migration.

Compare the test pieces pictured above. They show how much more protection WING-STAY S gives styrene rubber against direct sunlight than does another well-known nonstaining antioxidant. Your own tests will give you further proof of its superiority. So write, today, for samples and the latest *Tech Book Bulletins*. The address:

Goodyear, Chemical Division,
Akron 16, Ohio.

CHEMICAL
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for bonding N-types.

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for bonding Neoprene

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RECOMMENDED FOR THE SEVEREST OF STATIC, DYNAMIC, AND CHEMICAL RESISTANCE REQUIREMENTS!

TY-PLY is the ideal choice for vulcanized bonding of rubbers to metals under varying process conditions. Recommended and used for the widest variety of rubber-bonded units to meet the toughest of static, dynamic and chemical resistance requirements.

TY-PLY will adhere most vulcanizable rubber compounds to almost any clean metal surface.

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Rubber extruders have been recognised as the most efficient machines for modern requirements. This type of machine is in four sizes having screw diameters of 2, 3, 4½ and 6 inches respectively.
Among the many advantages of extruders are—water cooled screw, steam heated and water cooled barrel and die head, constant or variable speed motor and screw, and screw speed indicator.
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when service is important... When high production, to exact standards is the order, machines must be 100% reliable—but of equal importance is an on-the-door-step service to keep your lines moving.

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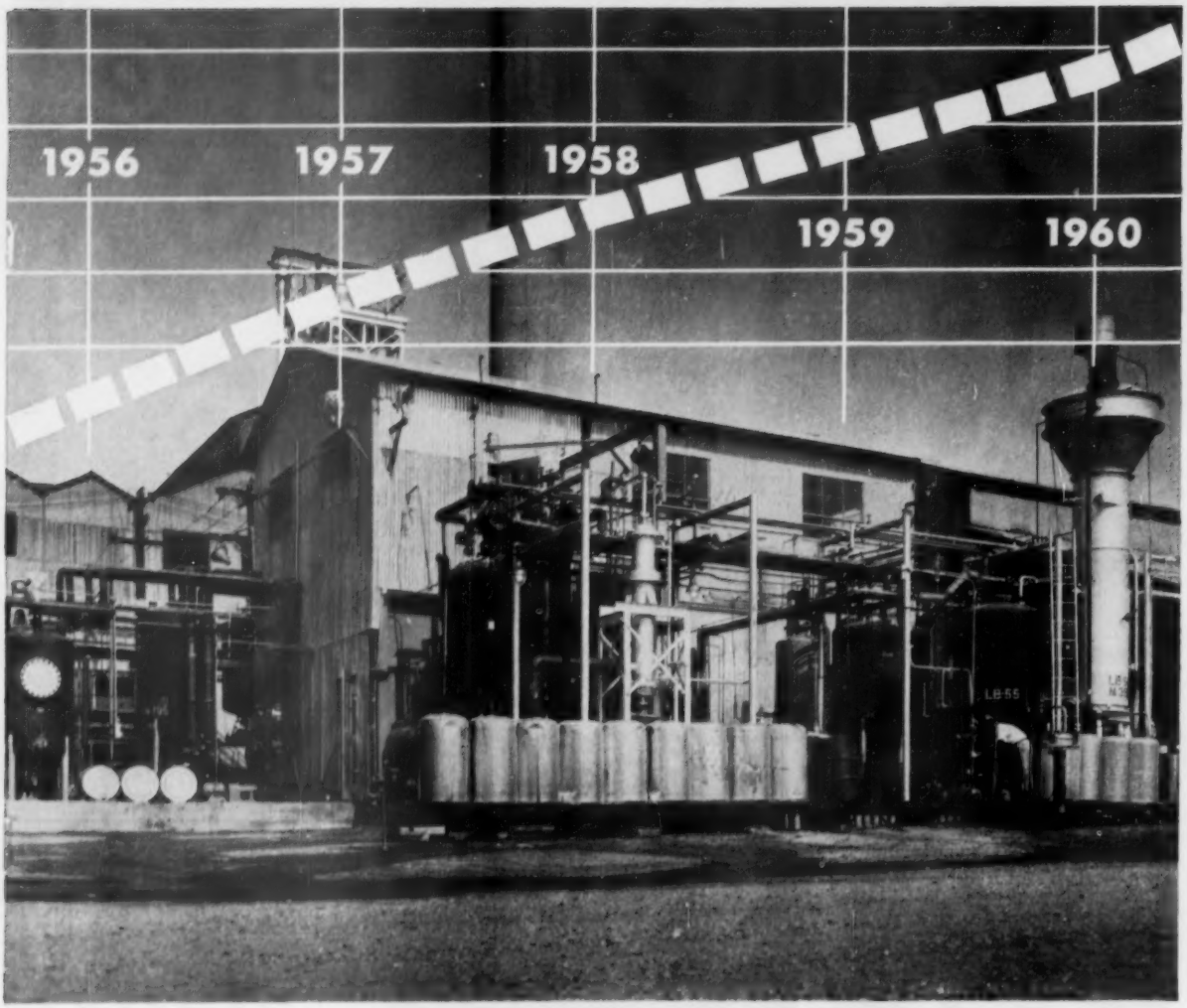

LOOKING AHEAD—This pilot plant is typical of Hercules facilities devoted to the development of new products for the rubber industry. Chart of future rubber consumption is projected on the basis of government statistics.

Hercules Facilities Keep Pace with Rubber Industry's Growth

This new pilot plant at Hattiesburg, Mississippi helps pave the way for new and improved rubber chemicals for tomorrow.

Hercules has pioneered in the development of Dresinate® rosin soap emulsifiers, and other products such as hydroperoxide catalysts and brick defoamers. New materials, the result of continuing research by Hercules, are now being readied for commercial production.

For further information on Hercules products for the rubber industry, write:

Rubber Chemicals Division
PMC Department
HERCULES POWDER COMPANY
INCORPORATED
918 Market Street, Wilmington 99, Del.

PR56-1

To help meet the increasing world-wide demand for synthetic rubber, the production capacity of ASRC is being expanded by 50%.

Current Polymers

Cold	Class
ASRC 1500	Staining
ASRC 1502	Non-staining
Cold Oil	
ASRC 1703	Non-staining
ASRC 1708	Non-staining
Hot	
ASRC 1000	Staining
ASRC 1001	Slightly staining
ASRC 1004	Staining
ASRC 1006	Non-staining

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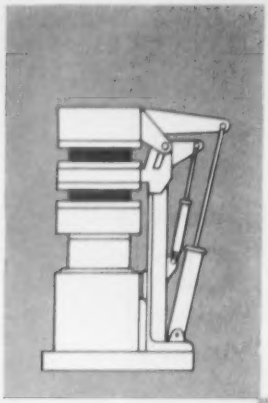
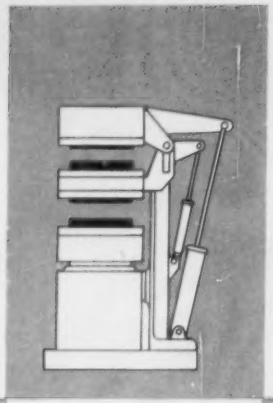
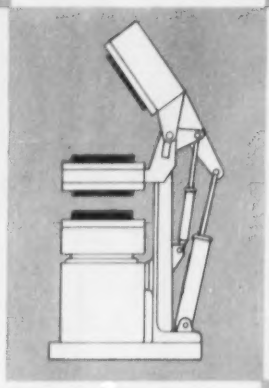


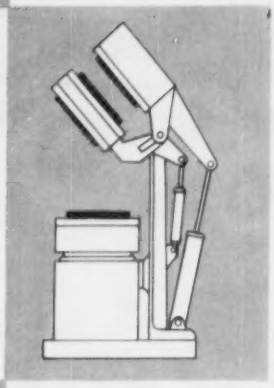
1 Completion of cure. Press is ready to open.



2 Press opens. Molds remain parallel during entire stroke of ram. This is necessary for deep cavity molds.



3 Head tilts back, exposing two halves of mold in top deck—cured articles are removed.



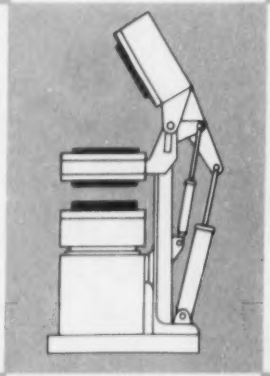
4 Intermediate platen tilts back, exposing two halves of mold in lower deck. Cured articles are removed. Fresh unvulcanized stock is placed in mold cavities.

deep, shallow

or transfer molding

easier with the

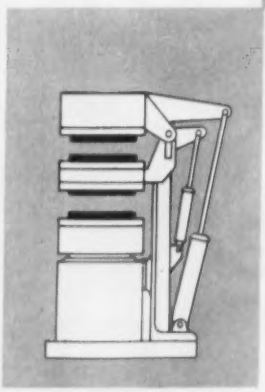
TILTING HEAD



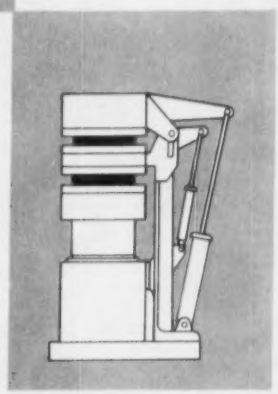
5 Intermediate platen lowers into parallel position—unvulcanized stock is inserted in mold cavities.

- Only the material moves in and out of the press. Molds remain in press, therefore mold halves stay in register.
- Cures two sets of molds at the same time.
- Timer, at prescribed intervals, automatically raises and lowers the ram, tilt head and intermediate platen.
- One operator, male or female, can attend to approximately as many presses as there are minutes in cure time. The operator simply removes cured articles and replaces with uncured, pre-formed stock.
- Press Sizes: 24-32-36" — up to 1,000-ton pressure.
- Two-Opening Press can be used as a single opening press for extremely deep molds.

REMOVE THE WORK WITHOUT REMOVING THE MOLDS



6 Head is lowered into parallel position.



7 Ram travels upward and closes press. DIRECT AND FULL PRESSURE OF HYDRAULIC SYSTEM IS AVAILABLE THROUGHOUT ENTIRE STROKE OF RAM.

Sales and Engineering by

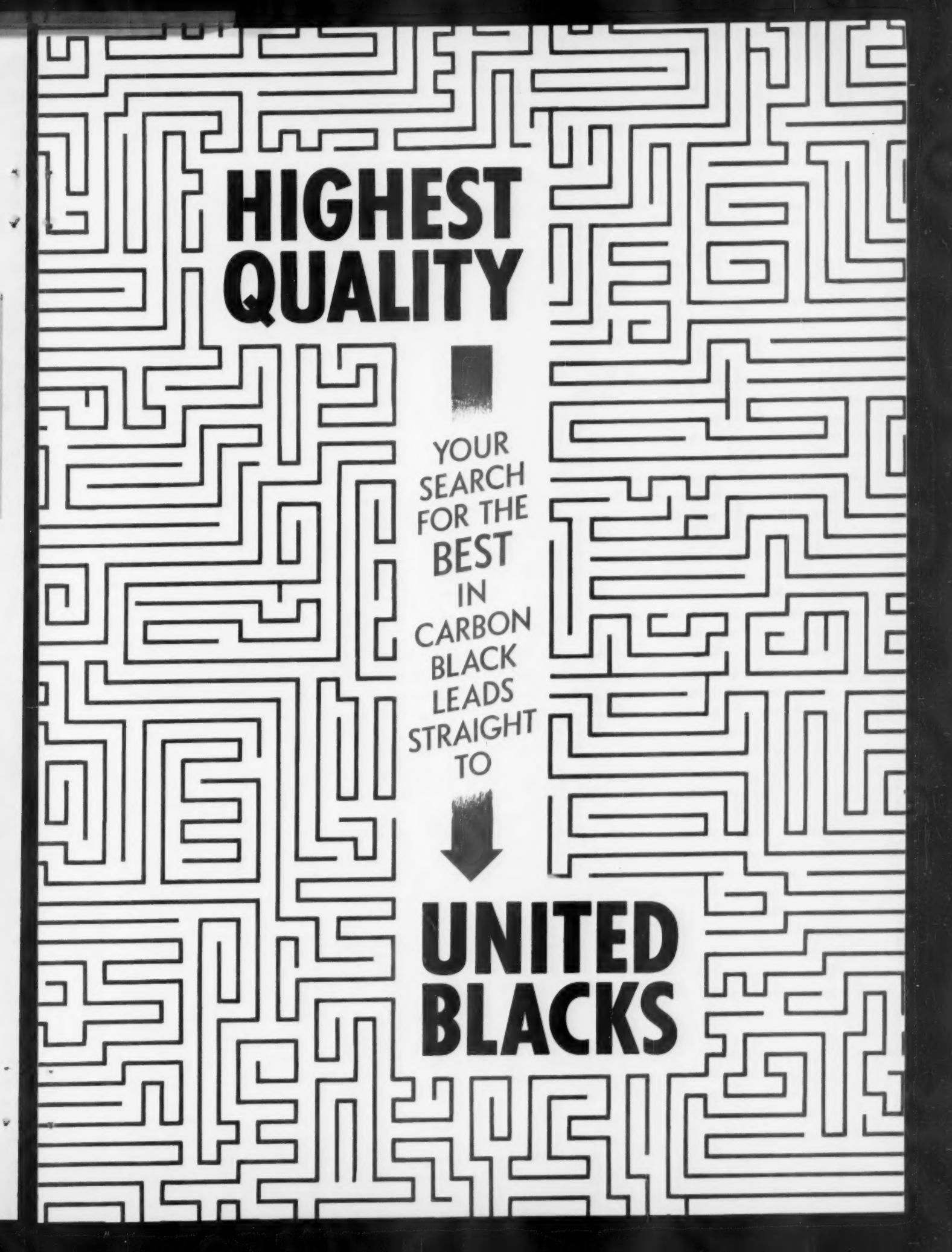
HALE and KULLGREN, INC.

P. O. Box 1231 · AKRON, OHIO

MANUFACTURED BY

THE AETNA-STANDARD ENGINEERING CO., PITTSBURGH, PA.

PLANTS IN WARREN, OHIO · ELLWOOD CITY, PA.


HIGHEST QUALITY
YOUR SEARCH FOR THE BEST IN CARBON BLACK LEADS STRAIGHT TO
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UNITED BLACKS

DIXIE 20

Dixie 20, Semi-Reinforcing (SRF) furnace carbon black, boasts by far the widest applications in various types of rubbers, and is indispensable to ever so many compounders.

Dixie 20 is non-staining and is most uniform. It is characterized by high loading capacity; easy and smooth processing; softness; a good balance of tensile, modulus, and high resilience; low heat build-up; high resistance to flexing; and improved aging — all this plus low volume cost.

Dixie carbon blacks are in the front for unsurpassed performance. It is wise to standardize on United carbon blacks and stay in the lead.

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A subsidiary of United Carbon Company

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for new equipment, spares or replacements . . .

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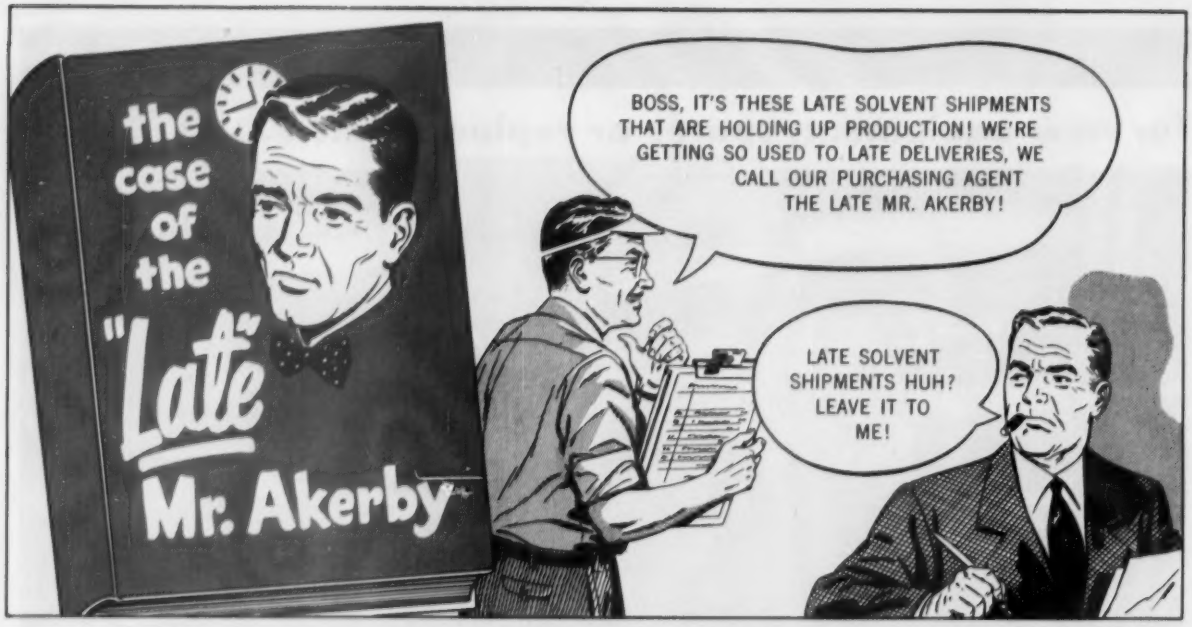
Designers and Builders of Ferrous and Non-Ferrous Rolling Mills, Mill Rolls, Auxiliary Mill and Processing Equipment, Presses and other heavy machinery. Manufacturers of Iron, Nodular Iron and Steel Castings and Weldments.


the case of the "Late" Mr. Akerby
BOSS, IT'S THESE LATE SOLVENT SHIPMENTS THAT ARE HOLDING UP PRODUCTION! WE'RE GETTING SO USED TO LATE DELIVERIES, WE CALL OUR PURCHASING AGENT THE LATE MR. AKERBY!
LATE SOLVENT SHIPMENTS HUH? LEAVE IT TO ME!

MR. WEBER OF SKELLYSOLVE TO SEE YOU MR. AKERBY.
YOU COULDN'T HAVE SHOWN UP AT A BETTER TIME! MAYBE YOU CAN HELP ME OUT OF A JAM OUR SOLVENT SUPPLIER GOT ME INTO.
PURCHASING AGENT

. . . AND YOU CAN FORGET YOUR SOLVENT DELIVERY WORRIES WHEN YOU SWITCH TO SKELLYSOLVE . . .
HERE'S WHY:
1. Your order phoned direct to Skellysolve plant.
2. Nine out of ten cars shipped the next day.
3. Shipping information sent to you promptly.
4. Skellysolve is quality-checked during production and before shipping.
5. Technical service backed by 25 years of Skelly experience.

NICE WORK! THERE WON'T BE ANY MORE "LATE" MR. AKERBY TALK SINCE YOU SWITCHED TO SKELLYSOLVE. EVERY SHIPMENT'S ON TIME —AND NOT ONE CASE OF CONTAMINATION!
BOY! AM I GLAD I LEARNED ABOUT SKELLYSOLVE IN TIME!

It may pay you to get further information about Skellysolve. Why not write or call us today?

Skellysolve for Rubber and Related Industries

SKELLYSOLVE-B. For making quick-setting cements for the shoe, tape, container, tire and other industries. Quick-drying, with no foreign taste or odor in dried compound. Closed cup flash point about -25°F.

SKELLYSOLVE-C. For making quick-setting cements with a somewhat slower drying rate than those compounded with Skellysolve-B. Closed cup flash point about 13°F.

SKELLYSOLVE-H. For general use in manufacturing operations and cements, where faster evaporation rate than that of Skellysolve-C is desired. Closed cup flash point about -16°F.

SKELLYSOLVE-L. For general manufacturing operations where a medium evaporation rate is required. Closed cup flash point about 12°F.

SKELLYSOLVE-R. For general use in tire building and a variety of other manufacturing operations and cements. Reduces evaporation losses. Medium quick final dry. Lessens bloating and skinning tendency. Closed cup flash point about -25°F.

Ask about our new Skelly Petroleum Insoluble Grease.

SKELLY **Skellysolve**

SKELLY OIL COMPANY
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TRADE MARK

New, Higher Density Zinc Oxide

INCREASES MIXING CAPACITY ... SPEEDS PRODUCTION

HERE ARE OTHER REASONS WHY AZODOX IS BEST FOR YOU

Twice the Density, Half the Bulk. Cuts storage space in half. Despite high density, perfect texture of material is unchanged. AZODOX package is shaped, permitting close-packed, well-formed unitized shipments.

Flows More Freely, Less Dusting than conventional zinc oxides.

Physical Properties Unchanged Except for Density. Surface area, size and shape, color and all other physical properties of AZO-ZZZ, American Process, zinc oxides are unaltered. *Apparent density only is changed.* All chemical properties are unchanged.

AZODOX Cuts Your Costs. Faster handling, easier storing, quicker mixing save you money.

AZODOX now ready for you in unlimited quantities. Priced the same as conventional zinc oxides. Available in surface treated form if desired.

Tests prove AZODOX, new form of zinc oxide (de-aerated), to be superior in all mixing operations. AZODOX incorporates readily, disperses completely in both hard and soft stocks, at high or low concentrations, on the mill or in the Banbury. Hard crust, common to pellets, is never present to cause dispersion problems. *Unlike pellets AZODOX does not consist of agglomerates.*

AZODOX is available in all grades of American process lead-free zinc oxide.

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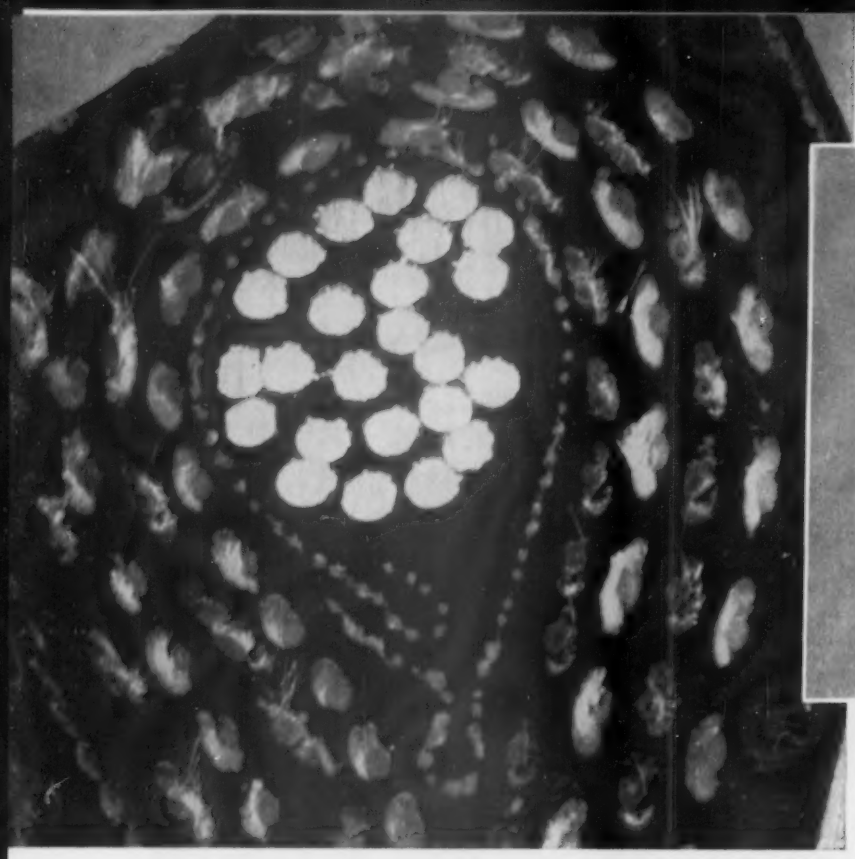


This cross-section cutaway, enlarged at left, reveals the secret strength in a deluxe U. S. Rubber Company tire made at Chicopee Falls, Mass. Twenty-four turns of high carbon wire such as made by Johnson give the tire's inner edges a firm anchor to an auto wheel rim.

Johnson Wire Used For . . .

A Tire's Hidden Muscles

U. S. Rubber Demands Best in Bead Wire

United States Rubber Company's big Chicopee Falls (Mass.) plant is "tire technology" in action. And if there isn't such a term as tire technology, there should be.

This special type of knowledge has kept automobile tires apace with automotive advances of the past 40 years. As American automobiles became heavier, stronger, speedier and more powerful, the tires they moved on developed new ruggedness and versatility.

Back in 1916, for example, the average auto weighed roughly 1,500 pounds. An average weight today might be in the 3,500-pound range, more than double.

Tire carcass strength today is twice that of 40 years ago.

Blue-chip tiremakers like U.S. Rubber will tell you of the many factors behind today's tougher tires. Some of them are visible in the finished tire—like improved design and better tread patterns. The invisible improvements—made possible by closer quality control, more efficient production machinery, better basic materials, such as the steel wires in the tires—all have contributed to producing more durable tires.

U.S. Rubber applies all these factors at its Chicopee plant, the largest tire plant east of the Alleghenies. Chicopee can turn out a new automobile tire every four seconds of a working day.

First step in making a tire is "wiring it for strength." This strength comes from the steel tire bead in the edge of each tire. A special high-carbon steel wire—about $\frac{1}{32}$ inch in diameter—is rubber coated and wound into a coil containing as few as three or up to hundreds of continuous turns. The number of turns in a bead is determined by the end usage the tire is to get. At U.S. Rubber, the number of turns for an automobile tire would range from 16 to 24, depending on the grade of tire. For one tire size, approximately 146 feet of wire are used per tire.

The coated wire is wound into the bead and a tape-like covering is applied to keep the coil solid. The bead is then incorporated into each inner edge of the tire, giving strength to the tire wall while serving as a practically unbreakable anchor holding the tire against the wheel's rim.

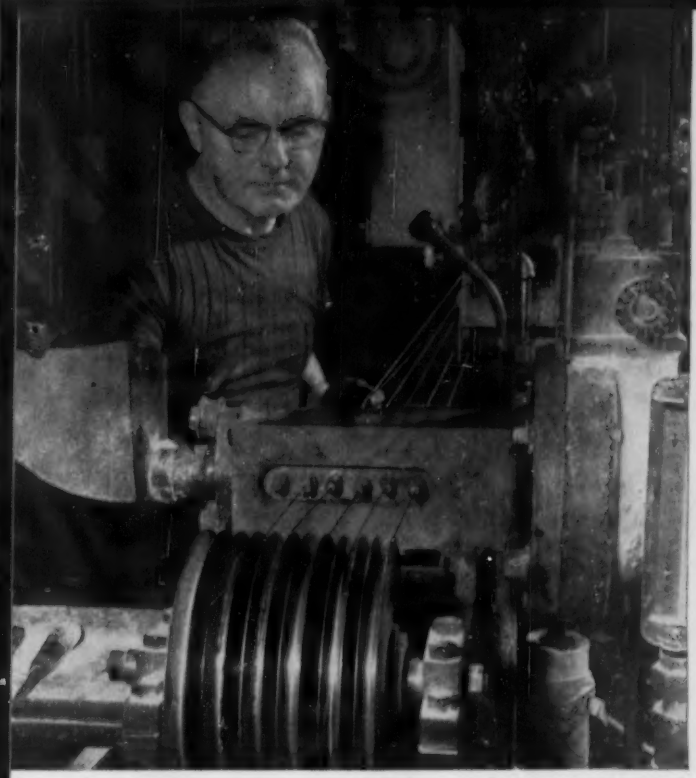
Because bead failure means tire failure, U.S. Rubber insists upon the finest in bead wire. That's why Johnson Steel & Wire Company, Inc., has developed into a major bead wire supplier to the Chicopee plant over the 25 years.

U.S. Rubber maintains rigid standards to insure getting wire of uniformly high quality. An order for wire or any other tire material is never placed until U.S. Rubber's quality control technicians have run complete quality tests.

In everyday operations, one in every 10 of the 600-pound reels Johnson ships to Chicopee is completely tested for tensile strength, elongation and straightness.

Johnson meets U.S. Rubber's specifications which, in part, call for wire that:

- **Presents a clean,** unbroken surface.
- **Has a good and uniform** bronze finish. Variation in the bronze coating could cause wire to freeze to a die. A poor coating also could affect the tight adhesion between the wire and rubber surrounding it. Unless this adhesion is maintained, the wire could exercise an extrusion effect which would fatally damage the tire.
- **Meets required breaking** weight standards. A single strand of $\frac{1}{32}$-inch tire bead wire has to exceed 285 pounds of breaking strength. This is equivalent to a tensile strength minimum of 275,000 pounds per square inch.



Six tire beads get their start in this machine in the Chicopee plant. Individual wires get a rubber coating here before being coiled into beads.

After each bead is tape-wrapped to hold the individual turns firmly, the bead gets a close inspection. By making a bead of one wire, the number of wire ends in a bead is reduced.

Two other standards U.S. Rubber has set apply to packaging and delivery.

In fact, Johnson's delivery and service are among the factors permitting the Chicopee plant to operate on a minimum four-day inventory for tire bead wire.

That's important because U.S. Rubber, like other tiremakers, must be cost-conscious. "This is a highly competitive business," says C. J. Allen, veteran purchasing agent at Chicopee, "and we've got to watch every cost right down to the mill."

U.S. Rubber figures it has held the line since 1931 in the cost to the motorist for every thousand miles driven. The figure 25 years ago was $4 for every thousand miles driven and it's still the same, even though the dollar is worth only half as much today and tire quality is twice that of 1931.

One of the means U.S. Rubber has followed to establish this achievement is through its insistence upon quality materials. You can have the benefit of this same advantage, if you use specialty wires. Johnson has a full range of the finest available specialty wires, as well as the engineering skill and experience required to match the proper wire to the product you make.

Whether it be wire for brushes, aircraft, bobby pins, high-strength springs, textile cards, reinforced rubber hoses or tires, you can depend on Johnson. There's full technical assistance waiting at any of the sales offices listed below.

It takes thousands of wire beads to meet daily production needs of U.S. Rubber at Chicopee, largest tire plant east of the Alleghenies.

Johnson Steel & Wire Company, Inc.

Worcester 1, Massachusetts

a subsidiary of **Pittsburgh Steel Company**

Grant Building • Pittsburgh 30, Pa.

District Sales Offices

Atlanta	Columbus	Detroit	New York	Tulsa
Chicago	Dallas	Houston	Philadelphia	Warren, Ohio
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Dynamic sculpture by Jose de Rivera—symbol of American Enka Corporation, one of America's great producers of synthetic fibers

Equipment means more than impressive plant facilities. Experience is equipment, too, and the long experience of the American Enka Corporation has produced outstanding developments in behalf of industry.

Tire manufacturers benefit from rayon that is now twenty percent stronger than ever. They know that tire cord made of high tenacity rayon offers ***premium safety at no premium in price.*** This is one reason why nine out of ten cars today ride on rayon. And American Enka is one of the leading producers of high tenacity rayon for tires, as well as for many other industrial uses. When you think of rayon for industry, be sure to call American Enka.

American Enka Corporation • *206 Madison Avenue, New York 16, N.Y.*

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Protection Against Ozone & Sunlight

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Low melting point of MICROFLAKE, plus its very small thin flake size assures rapid and complete dispersion during mixing. It has no effect on the rate of cure.

MICROFLAKE is recommended for passenger car, truck, and tractor tires, channel rubbers, weatherstrips, boots, gas tank filler, neck grommets, insulated wire and cable, hose, belting, footwear, clothing, druggist sundries, and sponge rubber products such as door and trunk sealers.

A test sample incorporated in any of your compounds will convince you of MICROFLAKE's outstanding protective qualities. Write us today. . . . No Obligation, of course.

Also Mfgrs. of **RUBBEROL** **SYNTHOL** and

GLYCERIZED LUBRICANT

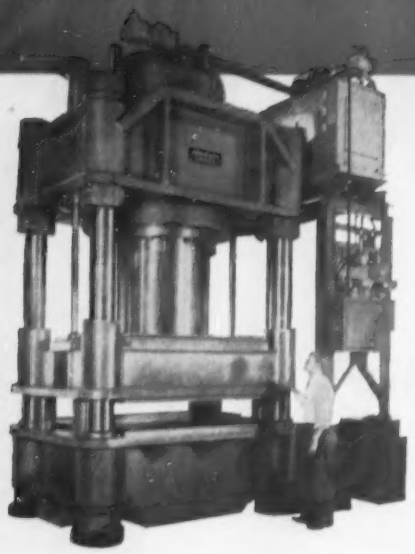
QUALITY SINCE 1884

GENSEKE BROTHERS

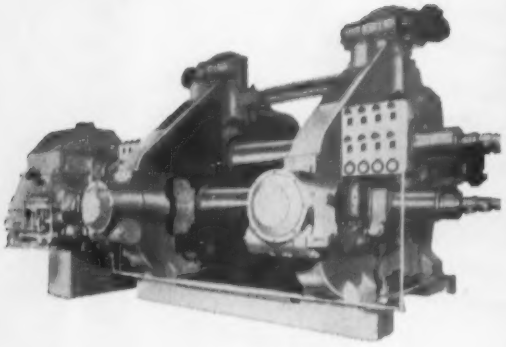
RUBBER MATERIALS DIVISION

West 48th Place and Whipple Street Chicago 32, U.S.A.

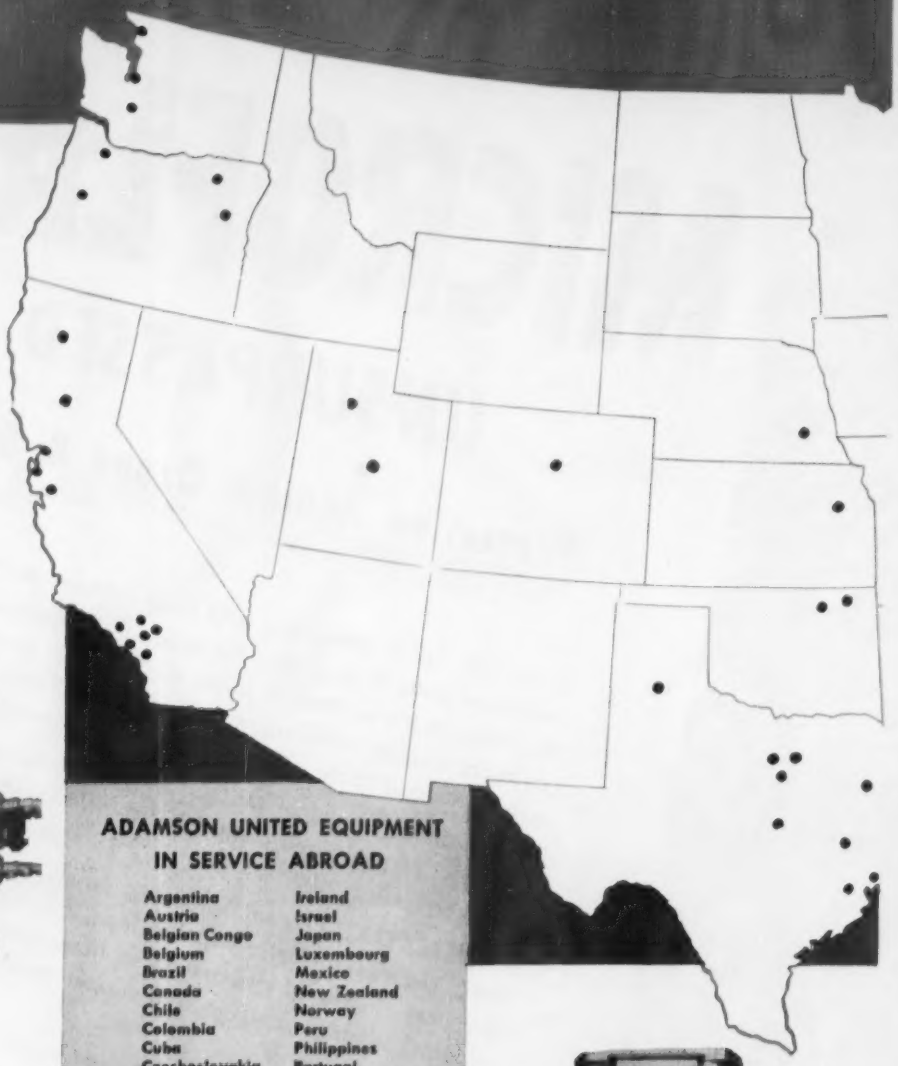
ADAMSON UNITED



1450 Ton Hydraulic Press



28" x 78" Four-Roll Z-Type Calender



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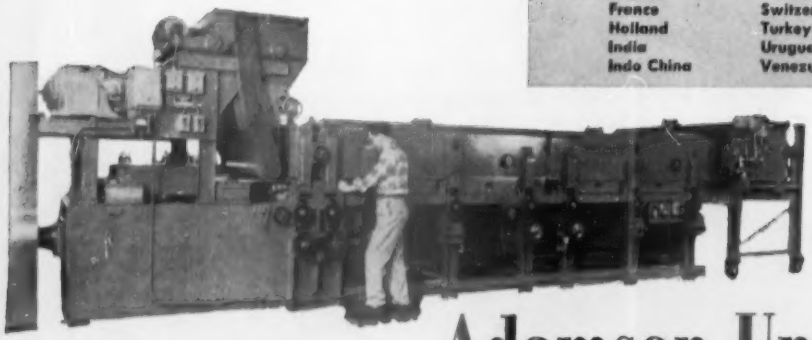
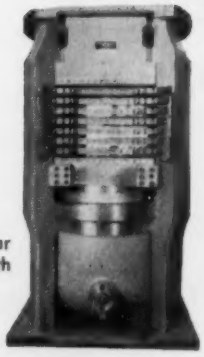


50" Continuous Chipboard Extrusion Press



30" x 30" Circular Side Plate Press with 30" Ram

Adamson United Company

730 Carroll Street • Akron 4, Ohio

Subsidiary of United Engineering and Foundry Company

Plants at: PITTSBURGH • VANDERGRIFT • YOUNGSTOWN
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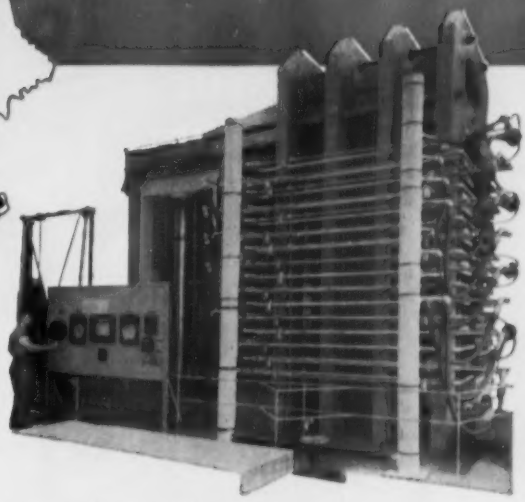
DEVELOPS—DESIGNS—BUILDS

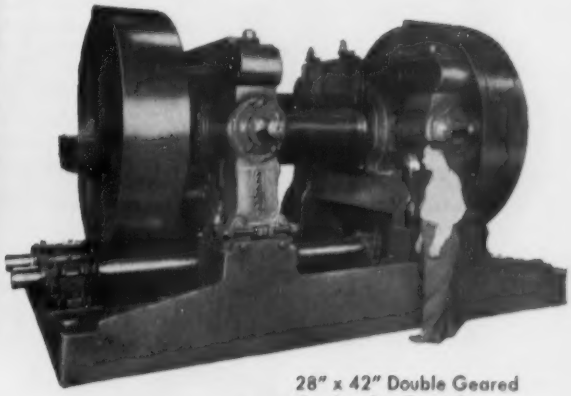
basic and special machinery

for **rubber • plastics • plywood • hardboard • chemicals • pharmaceuticals**

heavy testing equipment for the steel, automotive, and aircraft industries



54" x 124" Hydraulic Press
Platen Pressure—1500 psi



28" x 42" Double Geared
Cracker for Giant Tires

WHERE is ADAMSON equipment found?

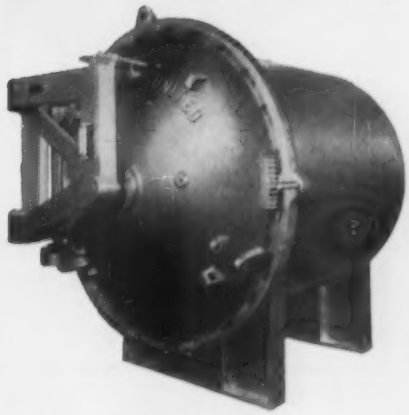
IN 40 OF THE 48 STATES. Each dot on the United States map represents a city in which ADAMSON equipment has been installed. ADAMSON equipment also sold to 32 foreign countries, as listed on the left.

WHO buys it?

77 percent of ADAMSON business is with the top 500 United States corporations listed in a recent issue of FORTUNE magazine.

Perhaps the best proof of the flexibility and scope of our manufacturing and engineering skill lies in the answer to those two questions—*WHERE* and *WHO?*

Our job is to serve big and little businesses alike. We welcome an opportunity to discuss your problems with you, either in your office or in ours.



72" I.D. Hinge Type Autoclave

Branch Offices in NEW YORK • CHICAGO • GREENSBORO, NORTH CAROLINA • *and* TORONTO, CANADA.
European Sales handled through GILLESPIE & COMPANY OF NEW YORK *with representatives in most European countries.*

BUILT ON THE SAME RUGGED PRINCIPLE AS OTHER WORLD-FAMOUS SCHRADER PRODUCTS . . .

ENCLOSED TYPE has plastic face and brass cap encloses plunger, protecting against dust and dirt.

STANDARD TYPE may be used to operate a micro-switch by rise and fall of the plunger.

Especially useful where space is limited. Engineered for long, hard use on all types of hydraulic machines. The Standard Gauges are industry's favorites.

Schrader Hydraulic Gauges

retain accuracy under SHOCK and OVERLOAD

Many thousands of these famous Schrader hydraulic gauges have given long years of dependable "work-horse" service in countless plants of every description

Schrader's full line of hydraulic gauges operate on direct action, using the spring-loaded principle. All replaceable parts are interchangeable. Maintenance and replacement of parts require no special tools or skilled labor. Do it in your own shop. No need for recalibration. **All are available in nine standard pressure ranges up to 5000 psi.**

SHOCKPROOF HYDRODIAL PRESSURE GAUGES

This completely enclosed unit has a durable plastic face with large, easy-to-read numerals that can be read from 50 feet. Snubber is built-in. Easy to install and maintain.

Order Schrader products by name from your supplier. Get the best in couplers, fittings, ferrules, clamps.

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FOR INDUSTRIAL PRODUCTION AND CONTROL

Vinyl compounders –

you benefit by specifying plasticizers made from

Indoil

OXO ALCOHOLS

Here's how – You sell finished product by volume rather than by weight. You get the most volume at lowest cost by buying plasticizers on the basis of volume of finished product, not weight of finished product. At equal cost per pound Oxo Alcohol plasticizers such as DIOP and DDP are cheaper to use. Here is a comparison:

	DOP	DIOP	DDP
Density 20/4	0.983	0.983	0.963
EMC* at 1,600 psi	50.3	51.4	53.7

**Equivalent Modulus Concentration (phr)*

INDOIL plastics evaluation laboratory checks quality of INDOIL Alcohols by testing finished product. Here operator measures elongation of plasticized vinyl strip to determine Equivalent Modulus Concentration of plasticizer.

No need to reformulate —Compounders plasticizing with DOP need not refigure formulations in order to use DIOP or DDP. They can be modified by using this table:

Ratio $\frac{\text{Plasticizer phr}}{\text{DOP phr}}$	100% Elong. at 1,600 psi	100% Elong. at 900 psi
DOP	1.000	1.000
DIOP	1.022	1.019
DDP	1.068	1.086

Contact your supplier – Ask your plasticizer manufacturer for samples of DIOP, DDP and other esters made with INDOIL Oxo Alcohols. INDOIL Chemical Company does not manufacture esters.

Information –Send for INDOIL Alcohol Data Bulletins Nos. 22 and 23.

INDOIL® CHEMICAL PRODUCTS

INDOIL CHEMICAL COMPANY, 910 South Michigan Avenue, Chicago 80, Illinois

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ENGINEERS SERVING THE RUBBER AND PLASTICS INDUSTRY FOR OVER 30 YEARS

Is AUTOMATION the Answer . . . for You ?

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Will it increase productivity, decrease costs, improve product quality—and to what degree? What capital investment is required, and how can it be amortized?

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Giffels & Vallet's broad experience in the planning and engineering of production facilities . . . for many companies in many industries . . . at home and abroad . . . has brought about a practical insight and understanding of the complex problems involved . . . and their solution.

This is experience available to you—in the development of new plant facilities and modernization programs.

G & V services are discussed in a special Rubber and Plastics Brochure. A copy will be mailed on request.

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COLD	PHILPRENE 1500 PHILPRENE 1502 PHILPRENE 1503	PHILPRENE 1601 PHILPRENE 1605
COLD OIL	PHILPRENE 1703 PHILPRENE 1706 PHILPRENE 1708 PHILPRENE 1712	PHILPRENE 1803 PHILPRENE 1806—similar to Philprene 1803 but incorporating 50 parts of PHILBLACK I.

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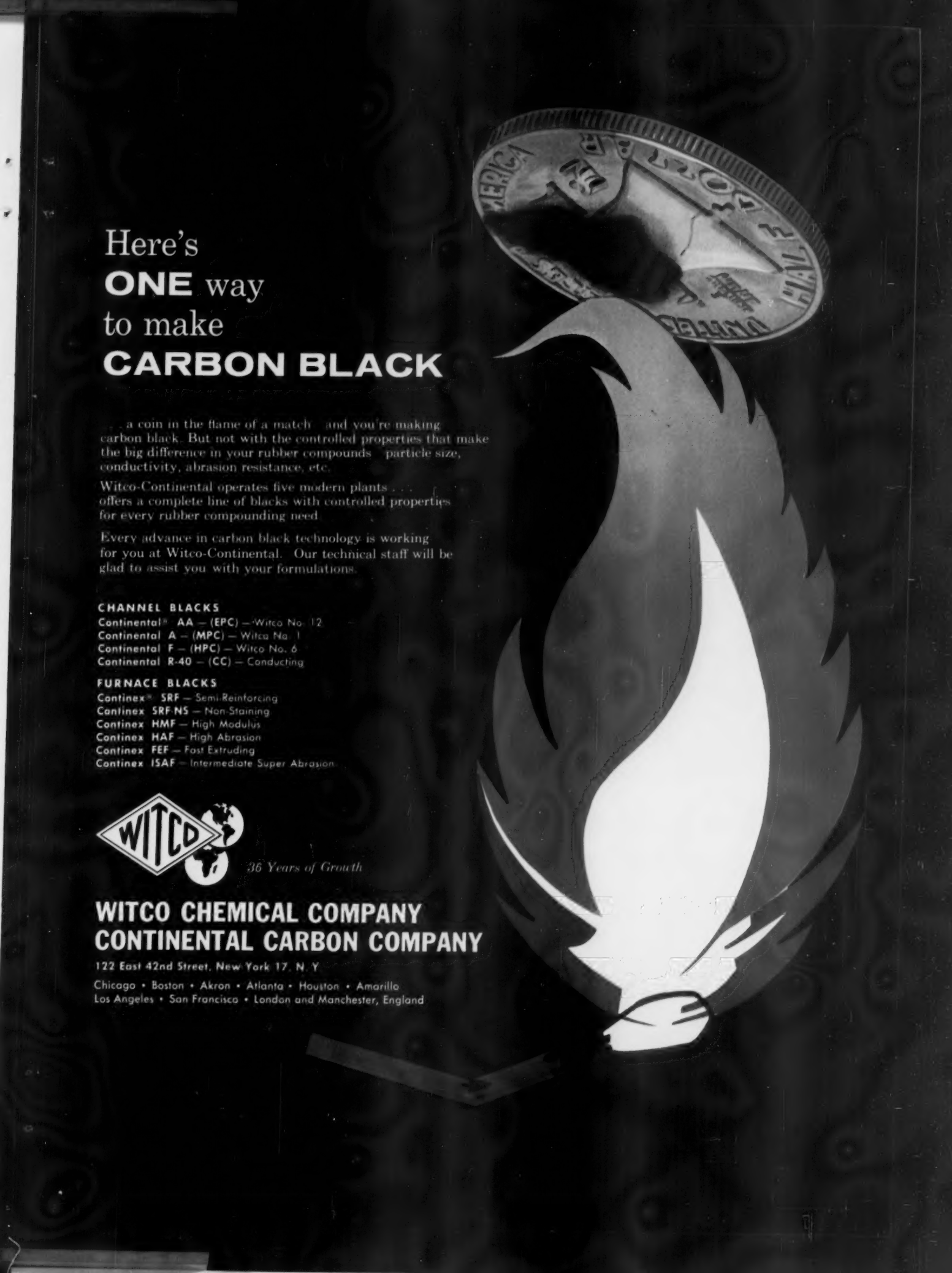

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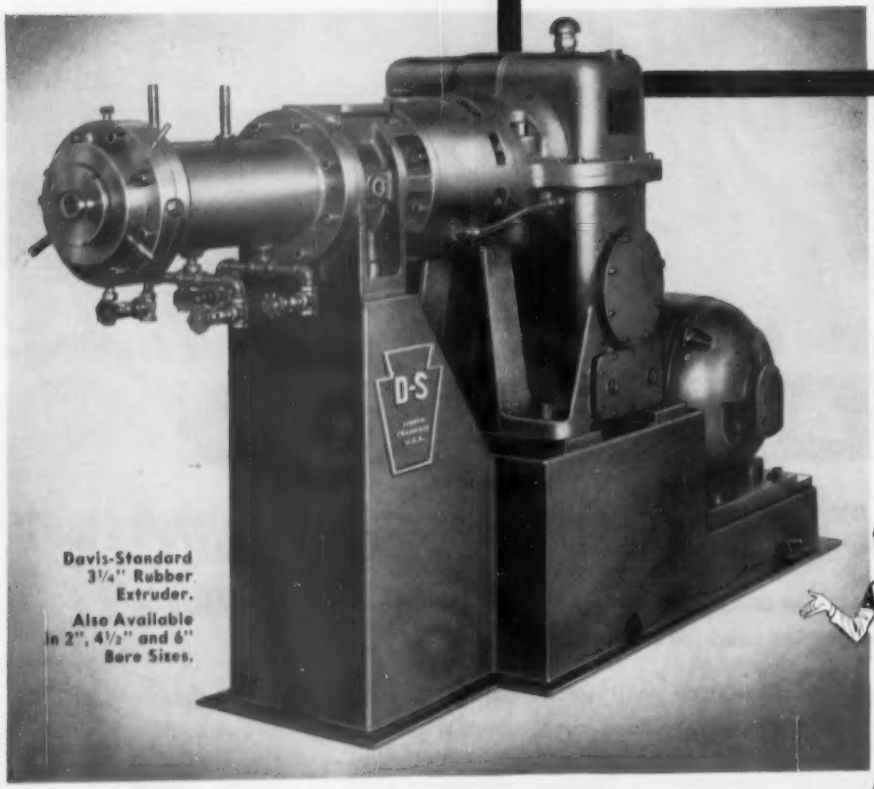

Davis-Standard 3¼" Rubber Extruder.
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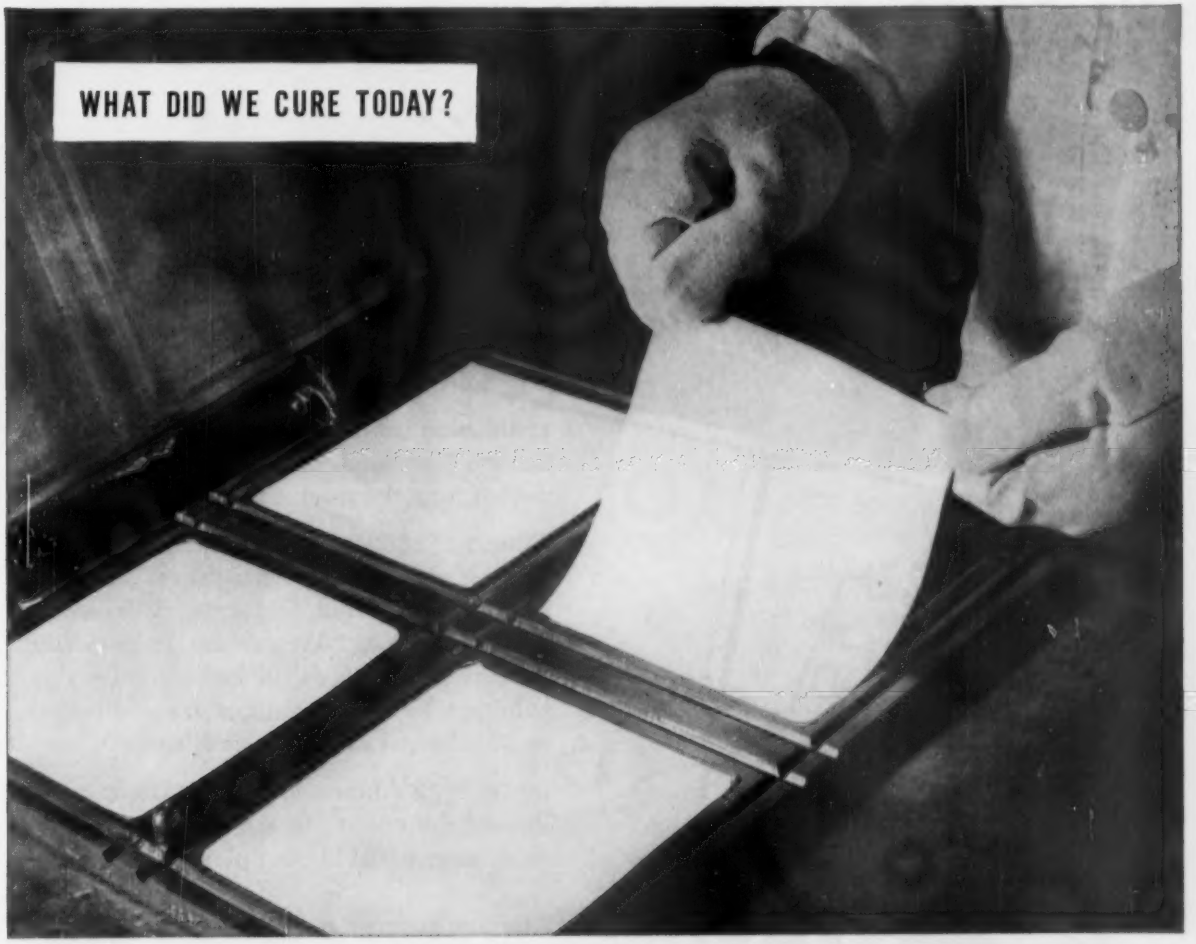

Natural Rubber . . . GR-S . . . Buna N . . . Silicones . . . Polyethylene? The above could be any of them or one of many other polymers, when versatile Di-cup is used as the curing agent.

DI-CUP* A NEW "CURE-ALL" FOR POLYMERS?

Coming off a curing press, this slab could be any of a number of materials that can be economically and efficiently cured with new Hercules Di-cup (dicumyl peroxide).

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Perfect separation of stock and liner is all important during these operations—for stock adhesions at either point cause expensive down time. You can avoid such production headaches by using Climco Processed Liners that can be readily peeled from the stock without sticking.

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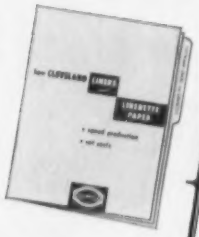

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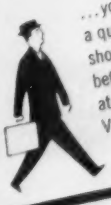

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HIGHER BONDING STRENGTH

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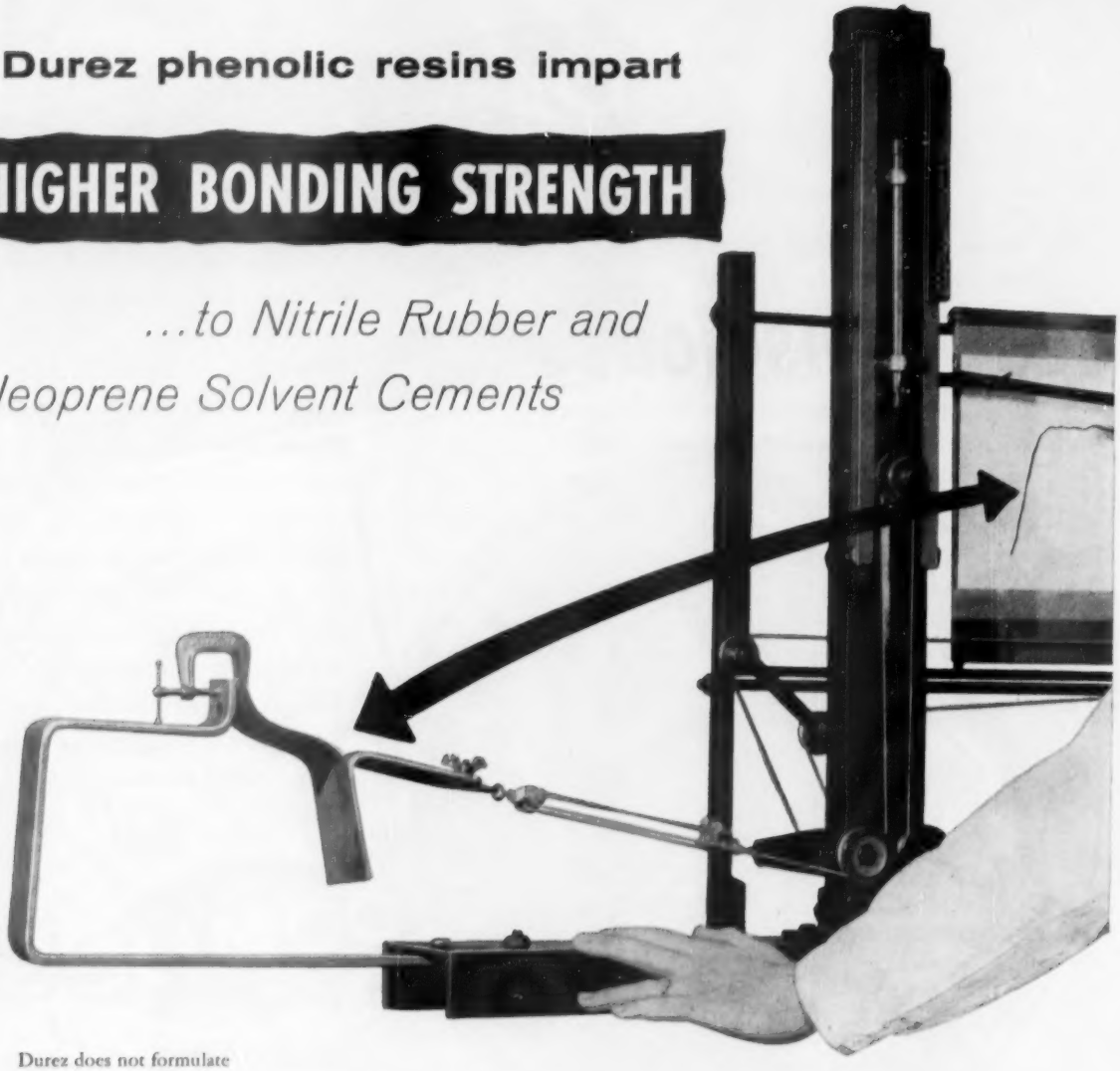

Durez does not formulate or manufacture adhesives, but serves those who use them by helping adhesive producers to make a better product.

Durez Phenolic Resins enable you to produce solvent-type adhesives having superior bonding strength. They are most effective as modifiers in nitrile rubber and Neoprene cements.

Those we recommend for nitrile have very good compatability and reactivity with the rubber, and the degree of film reinforcement, hardness, and flexibility can be closely controlled by varying the amount of the resin.

You can get ample film strength for most purposes with room temperature curing. When exceptionally high strength and greater heat resistance are needed, curing at temperatures of 250°F. or higher gives notable results.

In Neoprene solvent cements, a resin strengthens the film and provides a means of controlling the solvent release to produce the tack properties desired for specific applications. Cements of this type have good adhesion to a wide variety of surfaces including glass, steel and other metals, nylon, oak, and pine.

It will pay you to investigate the advantages of modifying your cements with Durez phenolic resins. As a starter, let us send you the latest edition of our bulletin on Resins for the Rubber Industry.

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DUREZ PLASTICS DIVISION

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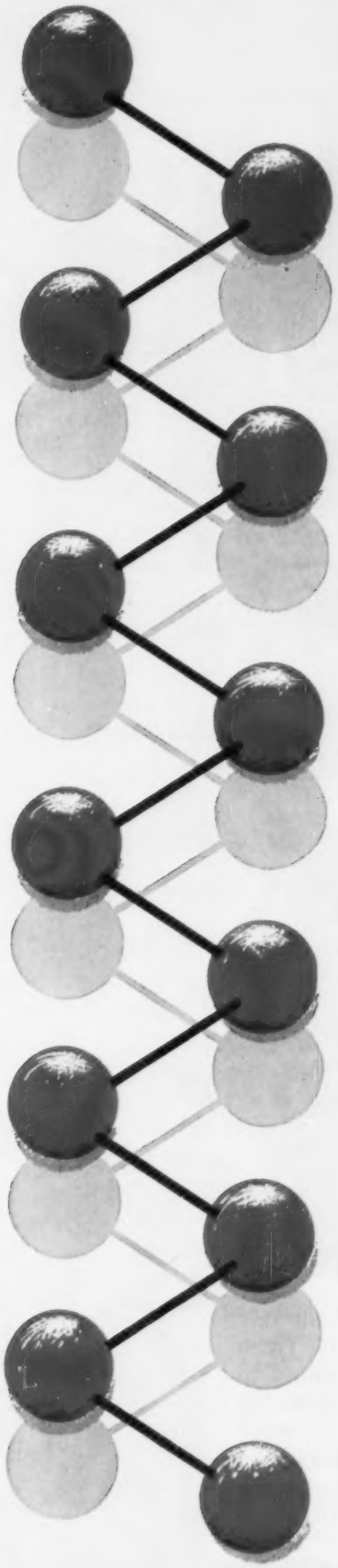


You'll want to read "SILICONE MODIFIED RUBBER"

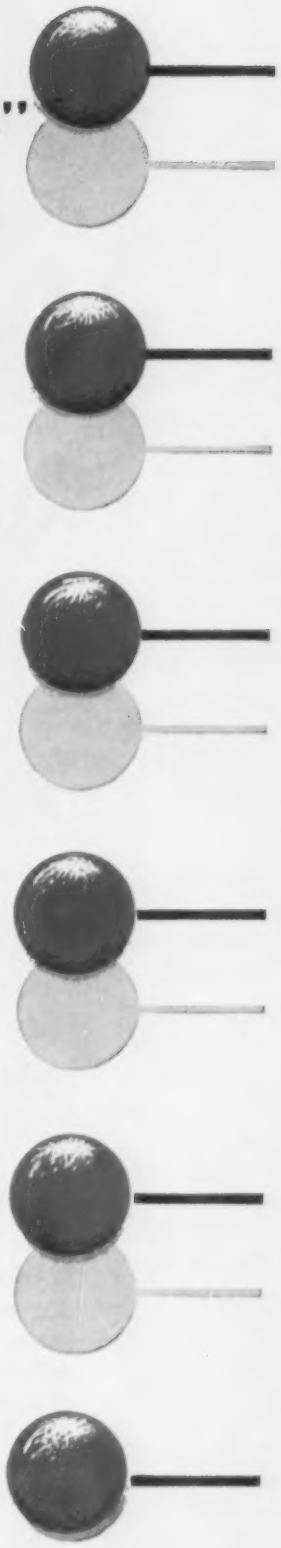
A new publication on Silicone Modified Rubber* calls the attention of technologists to another unique application for versatile Hi-Sil.®

The strong attraction of Hi-Sil 233 for certain silicone materials, with the resultant treated reinforcing silica then compounded into nitriles, polyacrylics, or other elastomer types, produces an unusual oriented filler network. Rather extensive studies are reported in this paper. Among the striking advantages of S.M.R. are improved plastic flow, faster stock mixing, and a surprisingly high level of physicals, particularly after heat and oil aging.

Low water absorption, increased resistance to acids and aromatic fuels, better abrasion resistance, compression set and electrical properties of silicone modified nitriles indicate possibilities for broader types of service with nitrile compositions.

Columbia-Southern is not offering the treated form of Hi-Sil 233 and requests should be forwarded to Mr. Phreaner. A reprint of Mr. Phreaner's paper is in process and will shortly be available in our bulletin series. For your copy, please address Room 1929-A at Pittsburgh, asking for Hi-Sil Bulletin No. 12.

*"Properties of Silicone Modified Rubber," *Rubber Age*, November 1956, by Ellis H. Phreaner, Consultant, Stoner Rubber Company, Anaheim, Calif.



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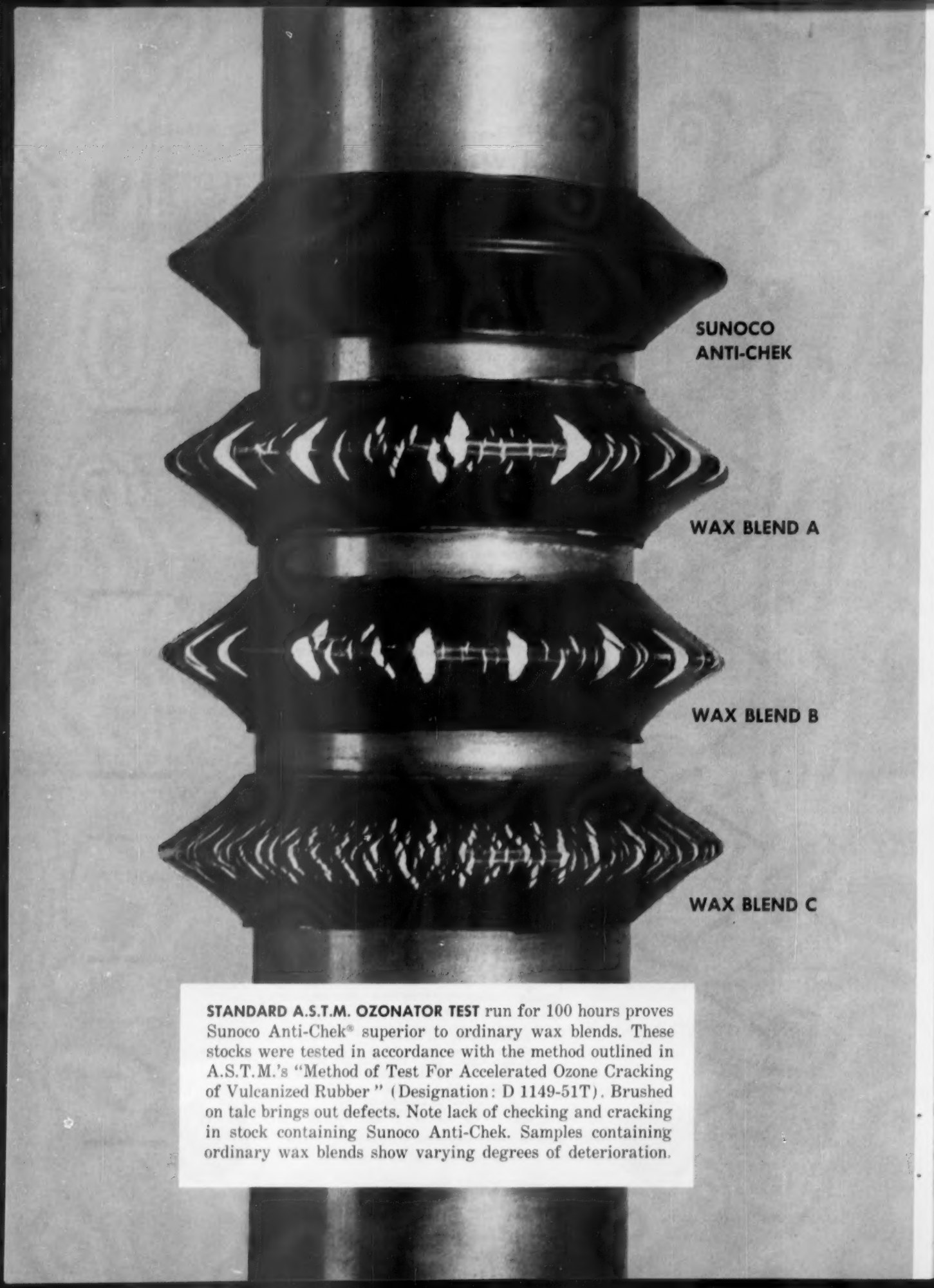
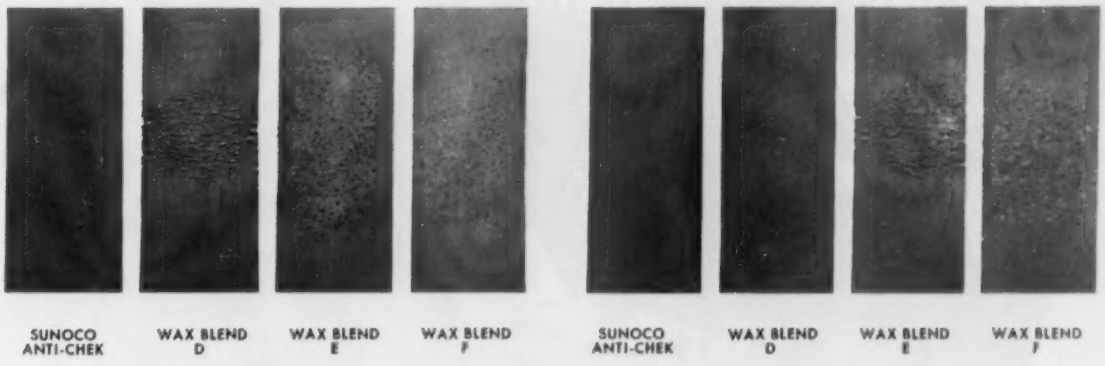


STANDARD A.S.T.M. OZONATOR TEST run for 100 hours proves Sunoco Anti-Chek® superior to ordinary wax blends. These stocks were tested in accordance with the method outlined in A.S.T.M.'s "Method of Test For Accelerated Ozone Cracking of Vulcanized Rubber" (Designation: D 1149-51T). Brushed on talc brings out defects. Note lack of checking and cracking in stock containing Sunoco Anti-Chek. Samples containing ordinary wax blends show varying degrees of deterioration.



LESS SUNOCO ANTI-CHEK NEEDED. These rubber test specimens show that *less* Sunoco Anti-Chek is needed to give *better* protection than you get with ordinary anti-checking wax blends. Ozonator and weathering tests prove that six parts of Sunoco Anti-Chek give equal or better protection than 10 parts of wax blends D, E and F.

Sunoco Anti-Chek Gives More Protection Against Cracking . . . Checking

After rigorous testing, Sun's researchers found that a special wax, Sunoco Anti-Chek, tailor-made for rubber, gave far greater protection than *ordinary* paraffin-microcrystalline blends that form brittle and much-too-thick films.

The rate of bloom determines how long an anti-checking wax protects rubber. Ordinary wax blends bloom too quickly and protection is short-lived. Sunoco Anti-Chek blooms at just the right rate to assure adequate long-life protection. In other words, to get protection for a given time, you need *less* Sunoco Anti-Chek.

For further information on Sunoco Anti-Chek, see your Sun representative or write for Technical Bulletin 30, SUN OIL COMPANY, Philadelphia 3, Pa., Dept. RA-11.

ASK FOR THIS FREE TECHNICAL LITERATURE

- Sun Rubber Process Aids (set of three bulletins describing product qualities of Circosol-2XH, Sundex-41, Sundex-53).
- Sunoco Anti-chek wax: Bulletin 30.
- An Ozonator for Accelerated Testing of Rubber: Bulletin 36.
- A Method for Classifying Oils Used in Oil-Extended Rubbers.

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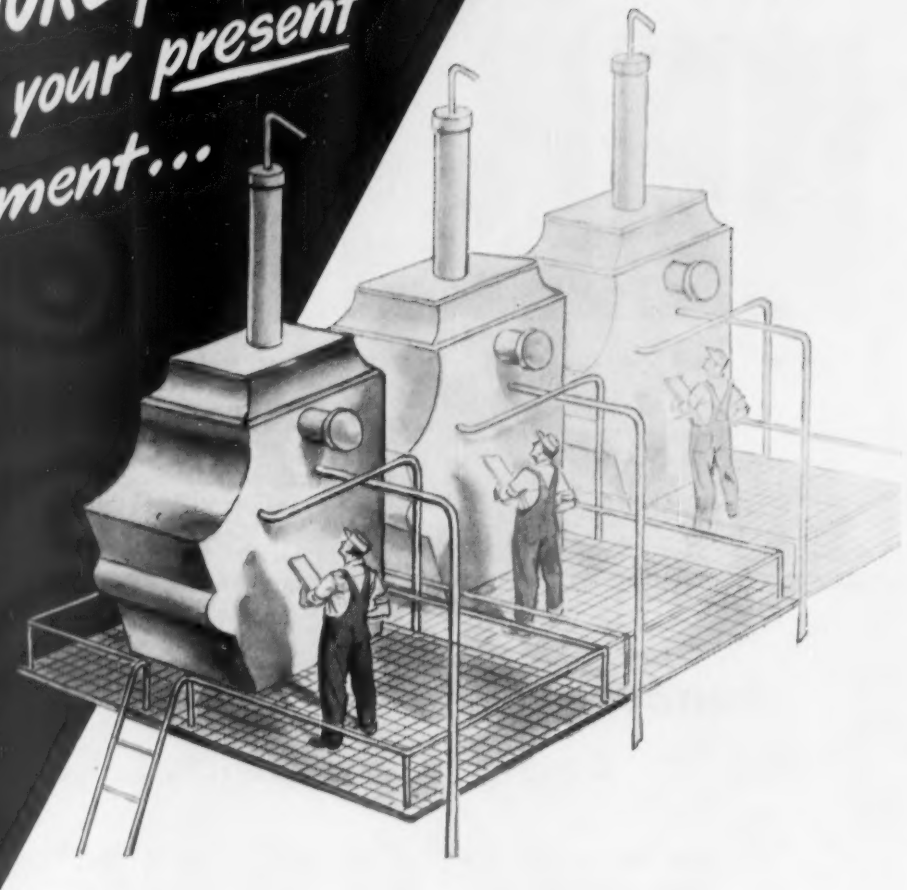

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New ideas can be the most practical, too. Formulations—like ideas—should change with the times. Like this idea that one rubber processor had that his tread stock could be improved.

The Problem: Produce GR-S/HAF black tread stock with maximum resistance to ozone under dynamic and static conditions.

Here's What Monsanto Compounders Did: Compounded a GR-S 1500/HAF black tread stock with Santoflex* AW alone and in combination with Flectol* H, Santoflex DD and three other commercial antioxidants. The stocks were also checked after the addition of paraffin.

The Results: Without exception, a stock with 2 parts of Santoflex AW proved most practical under dynamic or static exposure tests both in the ozone test chamber and in outdoor exposure. Paraffin was shown to add measurably to static ozone resistance without seriously harming the cracking under dynamic conditions.

Helping you get superior processing and product performance is the only way we can sell. So call upon 30 years of experience in helping *chemically* to make rubber processing more efficient, rubber products better. If you think your tonnage is too small for a special research project, don't hesitate to talk it over with Monsanto. Among the 18,000 or so special reports—the answer to your problem may already be at hand. Just call, wire, or write: *MONSANTO CHEMICAL CO., Rubber Chemicals Dept. RC-2 (Telephone: HEmlock 4-1921;, Akron 2, Ohio.*

*Reg. U. S. Pat. Off.

Accelerators • For fast, slow, and regulated rates of safe cure.

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Specialty Compounds • For special processing problems.

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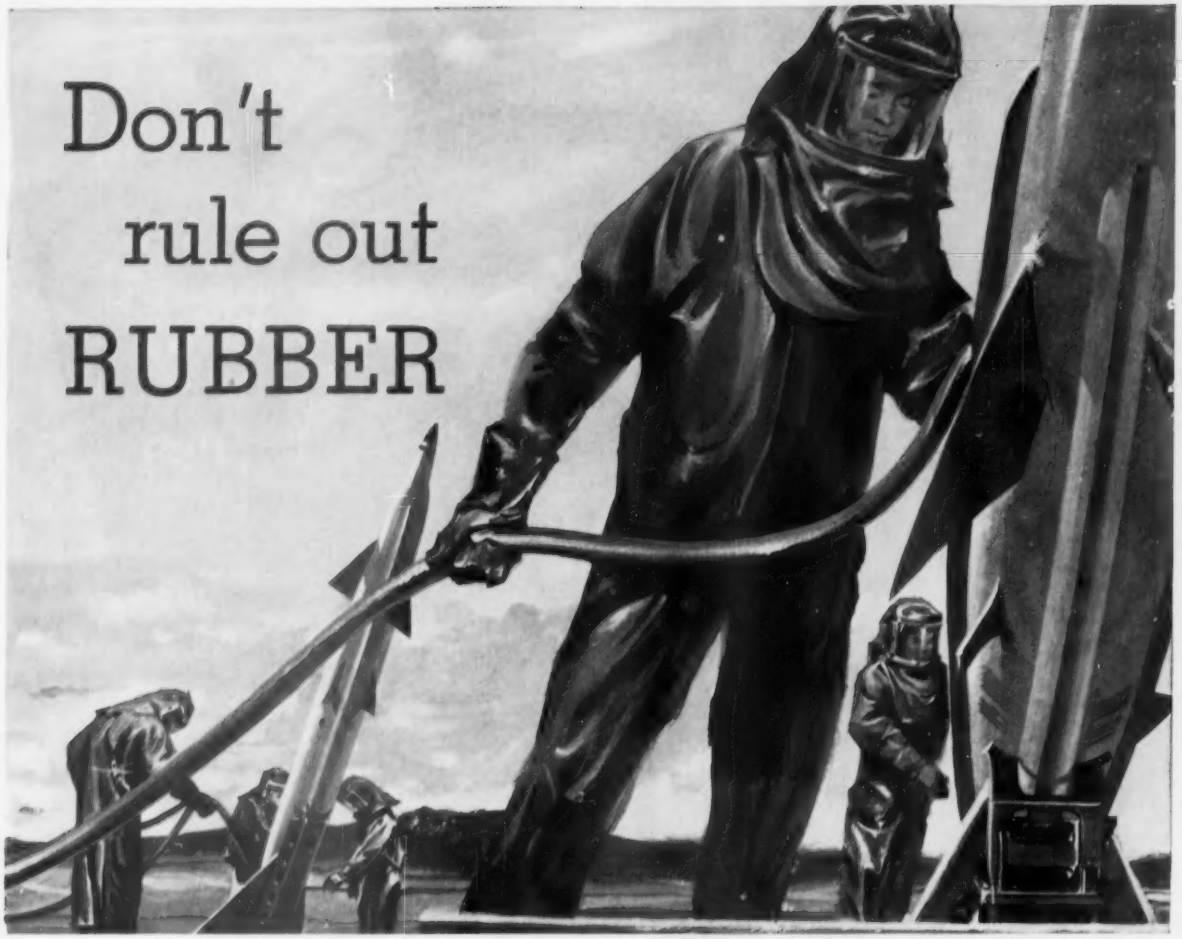

Transfer Hose of KEL-F Elastomer handles red fuming nitric acid over long periods of time without deteriorating. **Protective Clothing** of elastomer-coated fabric shields workers from corrosive materials.

KEL-F® Fluorocarbon Elastomers are doing jobs that rubber never did before!

Rubber is perhaps the most useful and versatile non-metallic material used by industry today. Its resilience and resistance to abrasion and breakdown make it an important tool in industrial techniques and plant equipment.

Yet in many applications—where the mechanical properties of rubber are vitally needed—extremely high-temperature and corrosive operating conditions rule out its use.

The development of KEL-F Fluorocarbon Elastomer fills a long felt need. Here is a high strength rubber that can operate effectively under conditions that swell, stretch and melt ordinary rubber.

Today, KEL-F Elastomer can be considered for those jobs once thought "impossible" for rubber. Just check its outstanding properties:

- Extreme resistance to acids, ozone, and other oxidants
- Thermal stability to 400°F.
- High resistance to solvents, fuels and lubricants
- Low moisture absorption
- Good dielectric properties
- Non-flammability

KEL-F Elastomers have convincingly demonstrated their value in a variety of industrial roles: As *sealants* for corrosive liquids, abrasion and corrosion resistant *pump impellers* . . . heat and chemical resistant *hose, tubing, diaphragms, gaskets . . . transmission, brake* and *aircraft seals* . . . corrosion and flame resistant *protective clothing* . . . electrical and shock *insulation*.

This new elastomer is a result of Kellogg's comprehensive research in fluorocarbon chemistry. Its performance characteristics are well established in the chemical, electrical and equipment fields. If your work involves rubber at any point, then KEL-F Elastomer warrants investigation.

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the world's most conductive carbon black

for antistatic and highly conductive rubber and plastics compounds

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An extra-conductive oil furnace black that's more conductive than any other carbon black in

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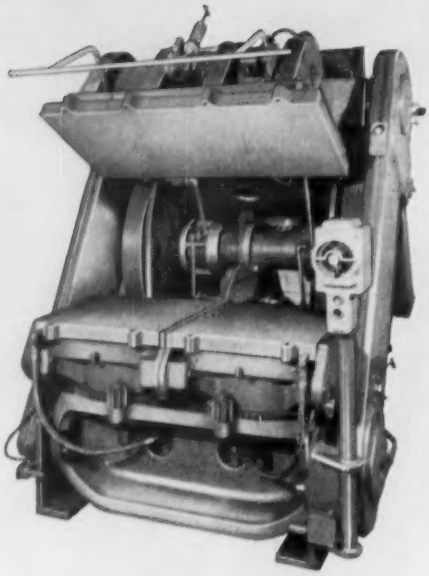
McNEIL-AKRON MODEL 800-32 TWIN PRESS

One of McNEIL's four heavy-duty "800" models in each of which the mold is contained within the press at all times. This prevents heat loss and possible mold damage during loading and unloading, saves operator's work and time. All models have finest safety and operating controls. All are designed, engineered and manufactured by experienced craftsmen for unequalled, precision performance!

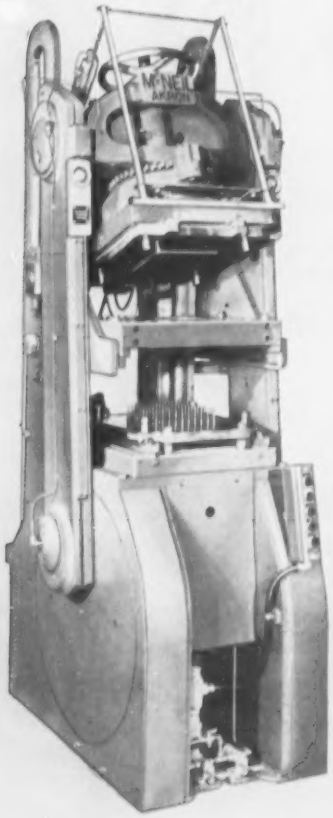
Shown is McNEIL Model 800-24 Twin Press that accommodates two 24" x 24" molds of varying thickness or one 24" x 48" mold. Over-all dimensions: 5'6¾" wide x 7'3¾" deep x 7'7⅝" high closed, or 7'0⅞" open.



A Money-Making Model for Every Production Requirement

NEW McNEIL-AKRON MODEL 300 PRESS

Fast-operating 18" x 18" "Big Brother" to our 10" x 16" "Bantam." Designed for quick transfer molding of small, close-tolerance products, this unit is adaptable to single or double daylight opening compression molding. Available with mechanical or air knockout mechanism. An automatic, efficient, high production unit. Over-all measurements: 2'11" wide x 5'9½" deep x 7'5¾" high closed, or 8'4¾" open. Requires only 18 sq. ft. of floor space.



McNEIL-AKRON MECHANICAL GOODS PRESSES

—Dependable, Efficient, Versatile, Speedy!

If you want better, easier, faster, safer and lower-cost production of mechanical rubber goods, you can get all that—and more besides—with McNEIL-AKRON Presses.

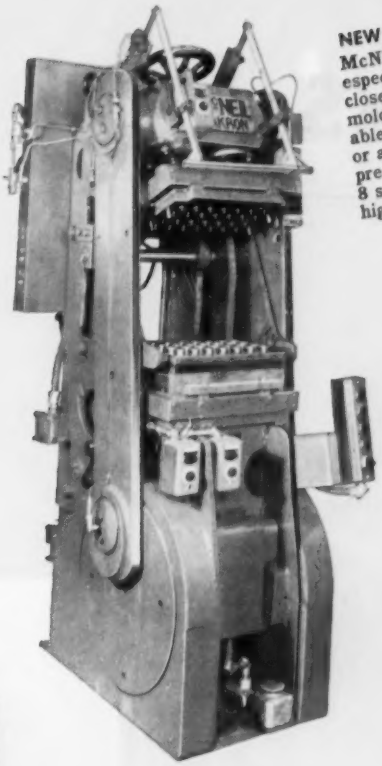
Included in the complete line of standard McNEIL-AKRON'S are both light-duty (zero to 110,000 lbs.) and heavy-duty (zero to 800,000 lbs.) models. Platen sizes range from 10" x 16" to 24" x 188". All of these famous presses, some of which are shown here, are dependable, efficient units of remarkable versatility. Handling everything from sponge and blown products to hard rubber and many plastic items, they also can be modified and adapted for a wide variety of special uses.

All McNEIL-AKRON models are compact, high-speed production units that provide constant mold temperatures, faster cures and consistently high quality production. All are electrically-operated with no pumps to service and no rams to pack. All models are equipped with automatic timers that govern the curing periods and also establish and regulate the bumping sequences and time intervals. All have automatic lubrication. And all models are built to McNEIL *precision* and quality standards and are as reliable and maintenance-free as only a McNEIL Press can be!

Best of all, every McNEIL-AKRON Press is a profit-producer. Economical to buy, own and operate, it will quickly pay for itself in profitable production! Consult us on your molding problems.

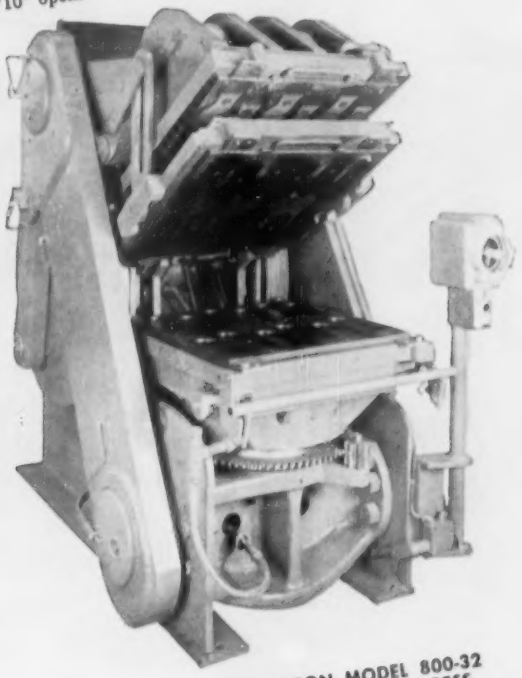
THE McNEIL MACHINE & ENGINEERING CO.

96 E. Crosier St. at Sweitzer Ave. Akron 11, Ohio



NEW McNEIL-AKRON MODEL 150 PRESS

McNEIL'S speedy 10" x 16" "Bantam," designed especially for transfer molding of small, intricate and close-tolerance parts. Handles 2-, 3- and 4-plate molds automatically. For compression molding, adaptable to single or double daylight opening. Mechanical or air knockout mechanism. 1000-lb. per sq. in. platen pressure and 400°F. temperature limits. Requires only 8 sq. ft. of floor space. 26½" wide x 44" deep x 5'10" high closed, or 6'10" open.



McNEIL-AKRON MODEL 800-32 INTERMEDIATE PLATEN PRESS

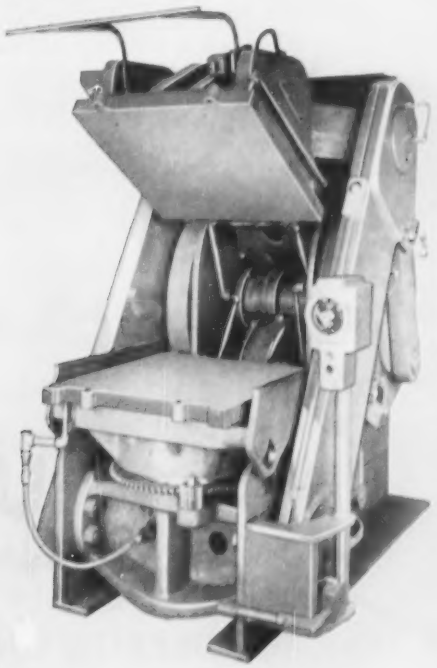
Another McNeil heavy-duty unit, built to meet the demands for tomorrow's higher production requirements. Equipped with a center platen automatically handled by press mechanism. Available with 32" x 32" platens in 8" and 10" maximum daylight openings. Maximum dimensions: 4'2½" wide x 7'4¼" deep x 7'9⅜" high closed, or 7'2⅛" open. No ejector mechanism.

THE NAME TO REMEMBER FOR PRECISION

Manufacturers of the World's Finest Rubber Curing Equipment

MANUFACTURING AGENTS: Francis Shaw & Company, Ltd., Manchester, England; Vickers-Ruwolt Proprietary, Ltd., Victoria, Australia; Luigi Pomini, Soc. in Acc. di Luigi e Carlo POMINI fu Egidio e C, Castellanza, Province of Verese, Italy; Etablissements Repiquet, Bobigny (Seine), France; Harburger Eisen Und Bronze-Werke A. G., Hamburg-Harburg, Germany.

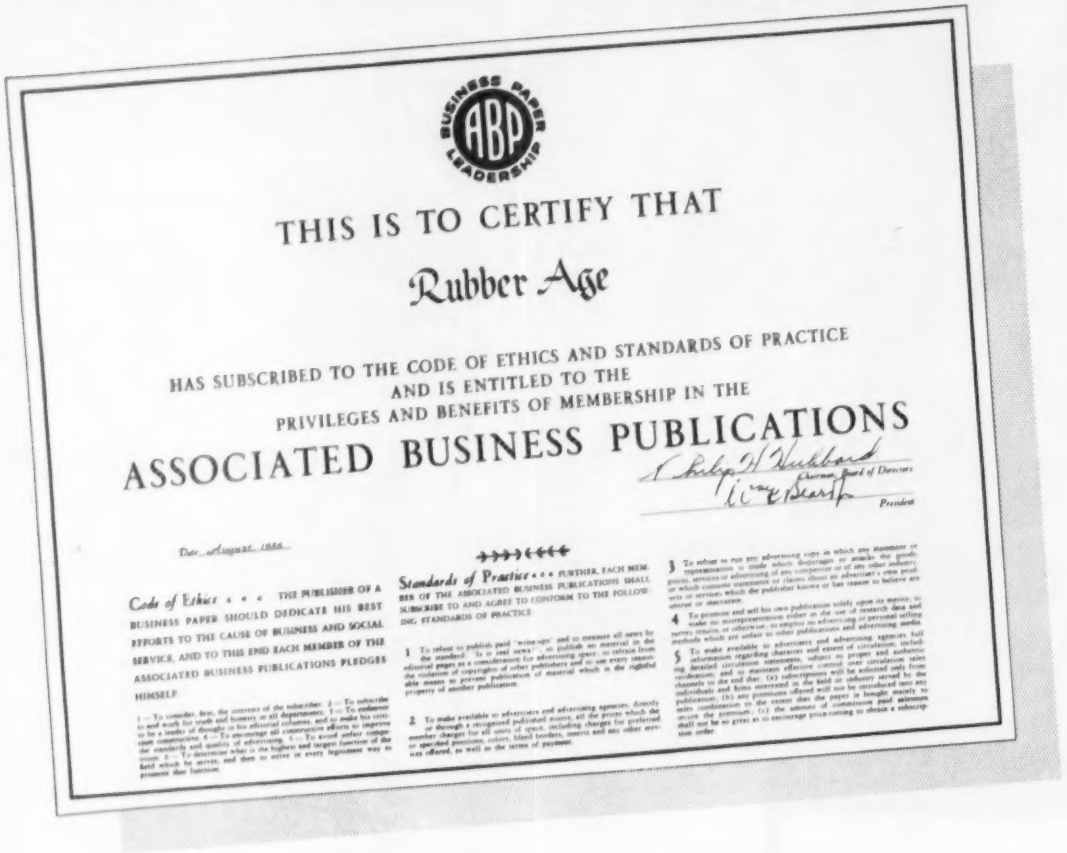
WRITE, WIRE or TELEPHONE TODAY for complete information.



McNEIL-AKRON MODEL 800-32 PRESS WITH EJECTOR

Still another heavy-duty McNEIL, shown here with adjustable ejector but also available without it. Has 32" x 32" drilled steam platen. Can be equipped with electric platens. Available with 6", 8", 10" and 12" maximum platen openings. Over-all dimensions vary with these openings but maximum size is 4'2½" wide x 7'4¼" deep x 7'11⅝" high closed, or 7'6" open.

RUBBER AGE JOINS ABP



THIS IS TO CERTIFY THAT

Rubber Age

HAS SUBSCRIBED TO THE CODE OF ETHICS AND STANDARDS OF PRACTICE
AND IS ENTITLED TO THE
PRIVILEGES AND BENEFITS OF MEMBERSHIP IN THE

ASSOCIATED BUSINESS PUBLICATIONS

Chairman, Board of Directors

President

Date August 1956

Code of Ethics . . . THE PUBLISHER OF A BUSINESS PAPER SHOULD DEDICATE HIS BEST EFFORTS TO THE CAUSE OF BUSINESS AND SOCIAL SERVICE, AND TO THIS END EACH MEMBER OF THE ASSOCIATED BUSINESS PUBLICATIONS PLEDGES HIMSELF:

Standards of Practice . . . FURTHER, EACH MEMBER OF THE ASSOCIATED BUSINESS PUBLICATIONS SMALL SUBSCRIBE TO AND AGREE TO CONFORM TO THE FOLLOWING STANDARDS OF PRACTICE:

RUBBER AGE is proud to acknowledge membership in the Associated Business Publications, a fifty year old organization of some 160 journals whose circulation, like that of RUBBER AGE, is on a fully paid basis.

For our readers, the practical benefits of our membership in ABP may be likened to a reader's membership in a local rubber group and the ACS Division of Rubber Chemistry. Educational programs and the constant exchange of ideas and information will mean, in simplest terms, our keeping up with all that's new in the publishing world — the business of presenting the latest information in the best manner possible.

The combined influence of ABP publications makes available to each member journal a variety of skilled professional talent and training facilities which might not otherwise be possible for an individual publisher to enjoy. From these will come the ideas . . . the knowledge . . . the inspiration that will make RUBBER AGE the better journal for its ABP membership.

ABC

ABP

RUBBER AGE

101 West 31st Street • New York 1, New York

COPO

means *good service* in **cold** rubber

means *pioneering* in cold rubber
means *uniformity* in cold rubber
means *well-packaged* cold rubber
and . . . means *high quality* cold rubber

COPOLYMER RUBBER & CHEMICAL CORPORATION
BATON ROUGE 1, LOUISIANA

COLD RUBBER SPECIALISTS!

PELLETED PROTOX ZINC OXIDES

Cut Dusting and Bag Loss

This simple test may surprise you:

Pour out a bag of non-pelleted zinc oxide and one of a Pelleted Protox. You will readily see the savings you can make through less dusting and less sticking to the bags by Pelleted Protox.

Some manufacturers report savings of about $20 per car due to less sticking of Pelleted Protox zinc oxides, plus additional savings from less dusting.

You will also find the following impressive savings from the low dry bulking of Pelleted Protox zinc oxides:

- **Lower unloading costs**
- **Lower intra-plant handling costs**
- **Less storage space**
- **Greater Banbury output**
- **Lower power consumption**

NON-PELLETED ZINC OXIDE

Zinc oxides in powder form tend to stick to the inside of the bags (above). Also they dust more than corresponding pelleted oxides.

PELLETED PROTOX ZINC OXIDE

This type of oxide makes possible significant dollar savings. It minimizes both sticking in the bags and dusting.

THE NEW JERSEY ZINC COMPANY

Producers of Horse Head Pigments
... the most complete line of white pigments—
Titanium Dioxides and Zinc Oxides

160 Front Street, New York 38, N. Y.

HORSE HEAD PRODUCTS

Naugatuck PYRATEX

gives super adhesion to carcass cords!

Planes, off-the-road trucks and earth-moving equipment put terrific strains on tire carcasses . . . strains that demand *super adhesion* in the rubber that bonds the carcass cords. And that's the kind of adhesion PYRATEX* gives to rayon, nylon or cotton cords!

This vinyl pyridine copolymer latex, compounded with resorcinal-formaldehyde, can be used full strength as a cord or fabric dip to produce *maximum* rubber-to-fiber adhesion. For lower-cost formulations the Pyratex-resorcinal-formaldehyde compound may be added to a butadiene-styrene latex in the proportion of 25 to 75 on the basis of solids content. For use as a cord dip the solution is further diluted to a solids concentration of between 10% and 20%.

Even this economical blend of PYRATEX gives RS-type latex almost *two-thirds more adhesion* to rayon and nylon fibers . . . greatly improves fatigue resistance.

Take advantage of the *super adhesion* of PYRATEX to give greater carcass strength and longer life to *your* tires, hose, belting and other fabric-reinforced rubber goods! Order a trial drum or truckload today . . . or contact your nearest Naugatuck branch office for further data.

*Naugatuck's trade name for its vinyl pyridine latex.

United States Rubber

Naugatuck Chemical Division

Naugatuck, Connecticut

BRANCHES: Akron • Boston • Chicago • Memphis • New York • Philadelphia • **Mfg.:** Naugatuck • Gastonia • Los Angeles • **CANADA:** Latex Div., Dominion Rubber Co., Ltd., Montreal • **Cable:** Rubexport, N. Y.
Rubber Chemicals • Synthetic & Reclaimed Rubber • Plastics • Agricultural Chemicals • Latices

look . . .

it's

TITANOX®

Smudging white sidewall tires is a woman's prerogative. And if you make white walls, it's *your* prerogative to whiten them with TITANOX-A (anatase titanium dioxide).

Nothing whitens and brightens rubber and plastic goods better than titanium dioxide pigments. And TITANOX white pigments are the No. 1 choice in titanium dioxide. Titanium Pigment Corporation (subsidiary of National Lead Company), 111 Broadway, New York 6, N. Y.; Atlanta 5; Boston 6; Chicago 3; Cleveland 15; Houston 2; Los Angeles 22; Philadelphia 3; Pittsburgh 12; Portland 14, Ore.; San Francisco 7. In Canada: Canadian Titanium Pigments Limited, Montreal 2; Toronto 1.

3848-A

No Discoloration with NONOX?

NEVER HEARD OF IT!

. . . a good tan can be very becoming on a pretty girl — but can prove very objectionable in light colored rubber stocks —

NONOX

Non-Staining Anti-Oxidants

WSL (LIQUID)

A very powerful non-staining anti-oxidant for many types of natural and synthetic rubber compounds . . .

WSP (POWDER)

An excellent non-staining anti-oxidant for polyethylene, also for a wide range of natural and synthetic rubber compounds . . .

THESE new non-staining anti-oxidants have been developed by Imperial Chemical Industries and are being introduced in the United States by their associates, Arnold, Hoffman & Company, Inc., Providence, R. I. and distributed to the rubber and plastics industry by Harwick Standard Chemical Co.

Write for complete data on the use of these products in various formula evaluations.

VULCACEL-BN

(BLOWING AGENT)

BLOWING AGENT for producing a fine, closed cell, even-sized pore structure in natural and synthetic rubber compounds, P.V.C. and Polyethylene.

HARWICK STANDARD CHEMICAL CO.

60 SOUTH SEIBERLING STREET, AKRON 5, OHIO

BOSTON 16, MASS. 661 BOYLSTON STREET
TRENTON 9, NEW JERSEY 2595 E. STATE STREET
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LOS ANGELES 21, CALIF. 1248 WHOLESALE STREET
ALBERTVILLE ALA. OLD GUNTERSVILLE HWY.

Light but tough!

modern protection based on WELKOTE

This 10′ x 14′ Welkote-based tarp is an easy load for one man.

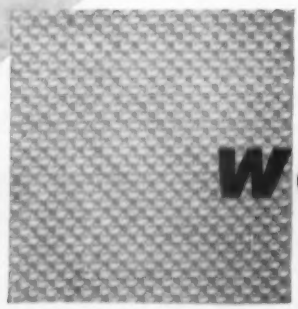
Welkote is at the very heart of the big change in protective coverings. On trucks and railroads, on playing fields, construction sites and oil fields . . . wherever dependable, lightweight protection is needed, you find more and more tarpaulins, tents and covers based on this Wellington Sears base fabric for neoprene and vinyl coatings.

Tough filament nylon Welkote teams up perfectly with vinyl and neoprene because it was specifically engineered for them. The finished Welkote-based product, when properly coated and fabricated, is amazingly light, yet strong beyond belief. Its remarkable tear strength and resistance to water, wear and weather, are already setting new long-term economy standards in many industries. Further, Welkote-based materials are easier to transport and handle (see picture above).

Welkote is widely specified by coaters. Supplied by Wellington Sears in three basic weights, it is one of many fabrics we engineer for the coating industry—and one of a long list provided to all industries for over a century.

This extensive experience is yours to work with in all our base fabrics, available for every coating use at Wellington Sears.

For illustrated booklet, write Dept. G-11



Wellington Sears

FIRST In Fabrics For Industry

For Mechanical Goods, Coated Materials, Tires, Footwear and Other Rubber Products

WEST POINT TEXTILES

Wellington Sears Co., 65 Worth St., New York 13, N. Y. • Atlanta • Boston • Chicago • Dallas • Detroit • Los Angeles • Philadelphia • San Francisco • St. Louis

Opportunity Knocking with a Triphammer Beat!

NATIONAL®
ADIPIC ACID

Volume production of Adipic Acid at our Hopewell, Va. plant opens the way to commercial development of new products based on adipic esters, particularly in plastics, plasticizers, rubber and lubrication oils. You are assured of uninterrupted supply based on our efficient, continuous process and fully-integrated production right back to basic raw materials within the Allied Chemical group.

National Adipic Acid is outstandingly good. It consistently analyzes 99.7% minimum purity, it is light in color and low in iron.

WRITE FOR TECHNICAL BULLETIN I-12

This 8-page bulletin gives complete physical and chemical properties; principal reactions of the carboxyl and alpha methylene groups; solubility curve, suggested uses and literature references. Working samples and quotation on request.

NATIONAL ANILINE DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 RECTOR STREET, NEW YORK 6, N. Y.

Boston Providence Charlotte Chicago San Francisco Atlanta Portland, Ore. Greensboro Philadelphia Richmond Akron Los Angeles Columbus, Ga. New Orleans Chattanooga Toronto

SUPPLIERS

Plan now on enough space to tell the full story of your products in the

RUBBER RED BOOK

Now, just when you are preparing 1957 advertising budgets, is the time to plan on advertising space in the 1957-58 RUBBER RED BOOK. This Directory, the only one serving the five and one-half billion dollar rubber industry, is the most widely used reference book in the field. Technologists of every type, purchasing agents, plant management — all find in the RUBBER RED BOOK the answers to their daily problems. No other single book answers so many questions. No wonder that you find well-thumbed copies on the desks of the industry's busiest men — the men who specify . . influence . . purchase goods of all kinds.

Your advertisement in the RUBBER RED BOOK will last for two full years. It will serve as a constant reminder of your company's products . . . materials . . . equipment . . . services. It will continue to sell for you long after your salesmen have left the customer, and will be available for study at the exact moment when buying decisions are being made. It will reach those people in rubber plants who influence the purchase of materials but whom your salesmen are unable to reach. It will place your products on a par with your competitors, many of whom were undoubtedly among the 382 advertisers in the previous edition.

USERS LIKE THE RUBBER RED BOOK

Here are just a few of the comments we've received: . . . valuable day-to-day reference . . . very useful and helpful in our dealings with suppliers . . . a distinct advantage many times for important reference . . . an invaluable service to the industry . . . exceptionally handy reference book . . . an encyclopedia, used regularly . . . the most complete reference book on rubber ever seen . . . our most useful and most used book on rubber . . . practically indispensable, finds constant use . . . tremendous value . . . time-saving.

These comments, extracted from letters on file, are from the very people you must reach to sell your products. That's why advertising in the one book they all use is a must. Make sure that these key people see your ad in the next issue. Allow for it in your budget . . . then, just to make sure, fill in and return now the coupon below.

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1 page	$200
½ page	110
¼ page	65
2 pages, each	195
2 half pages, each	107
2 quarter pages, each	63
Colors, Red	extra 75
Other Colors	extra 100
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Sales Agents Section:

In addition to standard one-quarter, one-half and full page units, there is available in the Sales Agents and Branch Offices Section only, a one inch unit @ $38.

For complete rates and sizes write for 1957-58 rate card.

RUBBER AGE, ...19....
101 West 31st St., N. Y. 1, N. Y.

You are hereby authorized to insert in the 1957-58 Edition of the RUBBER RED BOOK the advertising of the undersigned to occupy the space of ..... for which we agree to pay $..... as per your 1957-58 rates. (Copy will be sent you before April 15, 1957).

FIRM NAME _____

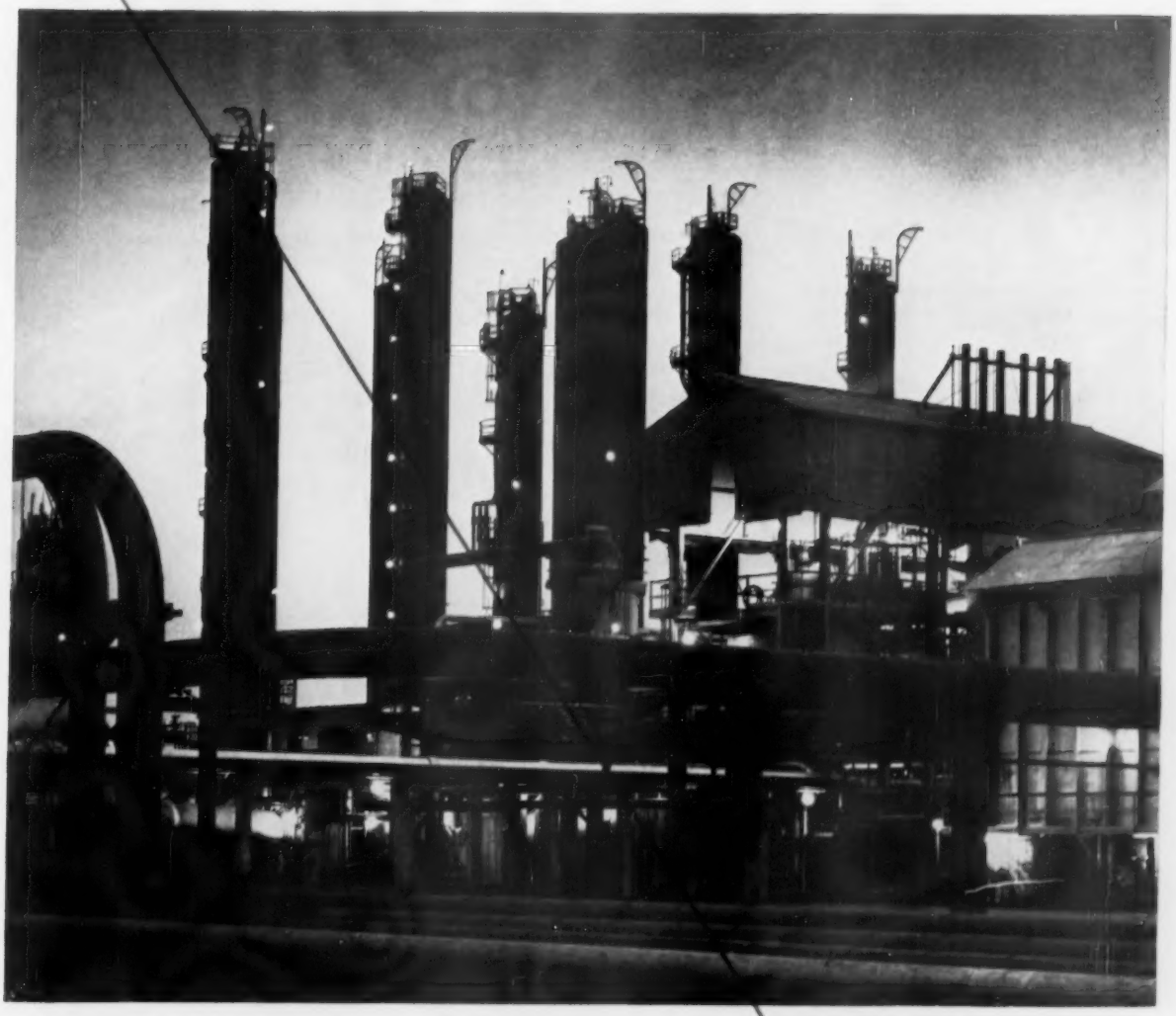
ADDRESS _____

SIGNED BY _____ TITLE _____

1156

Published by **RUBBER AGE** **101 West 31st Street New York 1, New York**

we don't call it a day...at night



Working night and day to achieve the goals set by the rubber industry, our Houston plant has compiled an enviable record during its first year and a half under Petro-Tex management.

Soon a major expansion of our facilities will provide ample supplies of butadiene for present and prospective users and also make available isomers of n-butylene 1 and n-butylene 2 for new products and markets.

We welcome an opportunity to discuss your present and future needs and our unique abilities.

BUTADIENE • n-BUTYLENE 1 • n-BUTYLENE 2

PETRO-TEX CHEMICAL CORPORATION

HOUSTON 1, TEXAS

JOINTLY OWNED BY

TENNESSEE GAS TRANSMISSION COMPANY AND FOOD MACHINERY AND CHEMICAL CORPORATION

Lucky it's ...

GEN—TAC®!

. . . FREEZING WON'T RUIN THIS CARGO!

That's right! Even when frozen and thawed, Gen-Tac's outstanding quality remains unaffected. When subjected to freezing temperature for hours at a time, Gen-Tac won't break down. Gen-Tac, General's proven vinyl pyridine latex, has excellent freeze stability, and assures the best fabric-to-rubber adhesion in tires and other applications. Write for literature and samples to The General Tire & Rubber Company, Chemical Division, Akron, Ohio.

Moisture degradation — Gen-Tac keeps this from happening to your tires. Cord treated with Gen-Tac adheres to rubber so well that moisture doesn't "wick" in to loosen the cords.

Curing blows—Gen-Tac cuts curing blows like this to a minimum because it is fast-curing and develops its strength in the early stages of cure when internal pressures do the most harm.

Adhesion—Gen-Tac treatment of tire fabric provides adhesion-to-rubber strength greater than the strength of the surrounding stock itself.

THE GENERAL TIRE & RUBBER COMPANY
Chemical Division
AKRON, OHIO

Chemical Division GENERAL THE GENERAL TIRE & RUBBER CO. GEN-TAC®

Creating Progress Through Chemistry

Another ***coating*** *problem solved by* ***Borden*** . . .

how a Borden chemical helped "launch" the atomic Seawolf

THE instant the Seawolf started her initial dive under the sea, a Borden chemical started protecting the Navy's mighty guardian of our shores from a constant enemy—corrosion in vital ballast tanks.

Here's the inside story: A submarine must flood sea water into her ballast tanks to dive . . . then blow it out in order to surface. Therefore, these tanks must be lined with a dependable coating resistant to the corrosive attack of sea water. To assure this vital protection, Borden's Resinous-Reslac Department furnished a coating that has been used for years in submarines . . . and has proved its superiority beyond question.

This submarine "protector" is but another example of Borden's creative chemistry at work in the coating field. If you have a product that may be developed or improved through use of the right resin emulsion, solution, or hot melt for adhesive bases, binders, coatings, sizes and saturants, take advantage of Borden's experience. *If time is of the essence . . . phone us and we'll have a technical representative at your plant within 48 hours.* The Borden Company, Resinous-Reslac Dept. RA-116, 103 Foster St., Peabody, Mass. In Chicago: Resinous-Reslac Dept., 3634 W. 38th St., Chicago 32, Ill. In Canada: American Resinous Chemicals of Canada Ltd., 20 Trent St., Toronto, Canada.

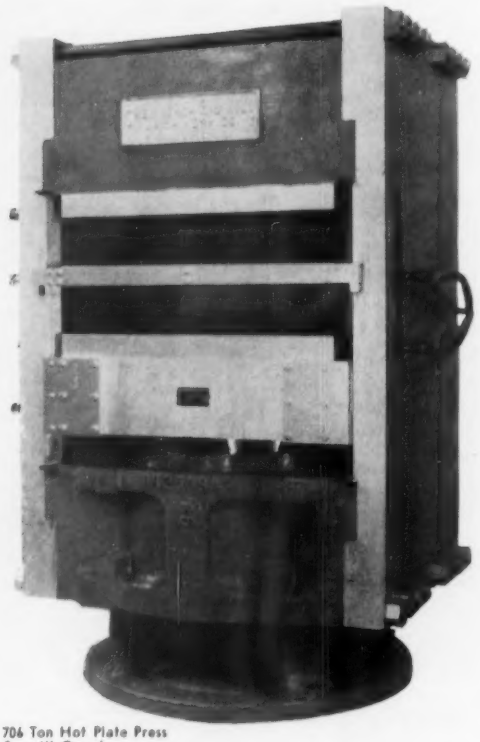
RESINOUS-RESLAC DEPARTMENT

THE *Borden* COMPANY

CHEMICAL DIVISION

FRENCH OIL MILL

SIDE PLATE PRESSES



706 Ton Hot Plate Press
2 — 6" Openings
36" x 36" Pressing Surface

Standard Sizes From 79 to 1385 Tons, and Pressing Surfaces From 20" x 20" to 50" x 50"

The French side plate press with patented construction features is the most rigid, highly accurate molding press available. Investigate how you can reduce costs and increase profits by using a French side plate molding press.

- **Improve close tolerance molding**
- **Decreases mold maintenance**
- **Reduce scrap losses**

Write for illustrated bulletin.

THE FRENCH OIL MILL MACHINERY CO.
(HYDRAULIC PRESS DIVISION)
1022 GREENE ST. PIQUA, OHIO

UOP
288
TRADE MARK
new help
FOR CRACKING CONTROL
YOU CAN ENHANCE SALABILITY OF YOUR
RUBBER PRODUCTS BY PROVIDING THEM COMPLETE
PROTECTION FROM OZONE CRACKING WITH
UNIVERSAL'S ANTIOZIDANTS UOP 88 AND UOP 288.
If your product is made of rubber, either natural or synthetic, you should protect it from ozone. With UOP 88 and the newer UOP 288 you can completely eliminate ozone cracking. Don't take chances with the salability of your product when it comes face to face with the potential customer. Don't jeopardize repeat business with merchandise that cracks and deteriorates. Use UOP 88 or UOP 288—premium antiozidants for superior products. Write us for details.
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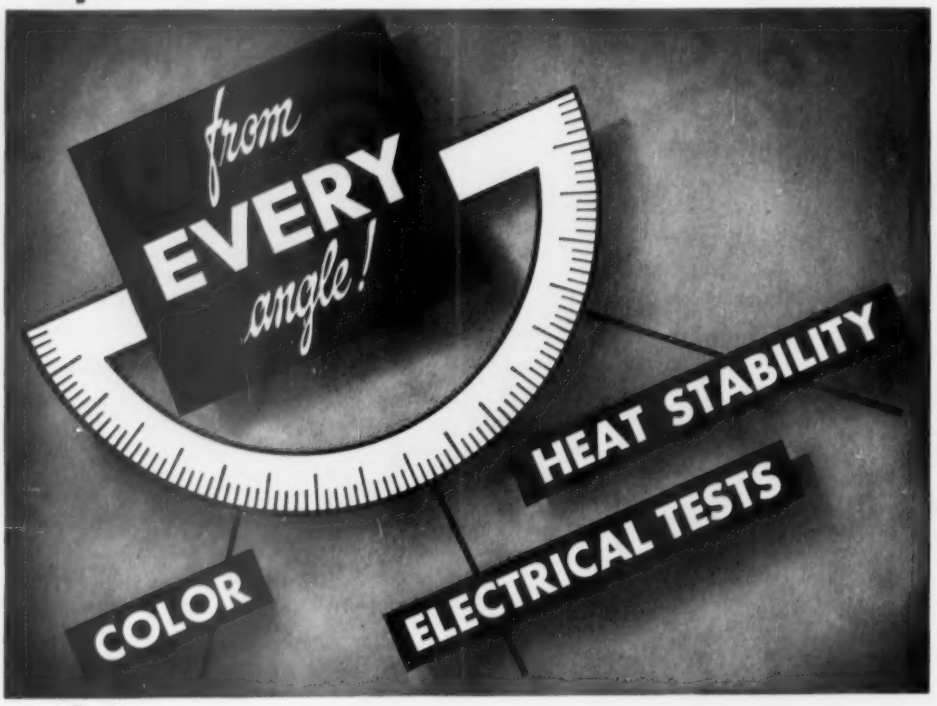
88
UOP
PRODUCTS DEPARTMENT
UNIVERSAL
OIL PRODUCTS
COMPANY
30 ALGONQUIN ROAD
DES PLAINES, ILLINOIS



PIGMENT NO. 33

for Compounding

VINYLS AND SYNTHETIC RUBBER

Sample and technical data sent promptly on request

SOUTHERN CLAYS, Inc.

33 RECTOR STREET
NEW YORK 6, N. Y.

Goodrich-Gulf Chemicals, Inc.

Ameripol...

"the preferred rubber" for exceptional products

MAN-MADE rubber—in the forms available as Ameripol—first proved itself a star performer in tire mileage tests. Thus it is now the preferred tread material on passenger, farm and small truck tires.

That was the starting point. Now Ameripol's use is being constantly broadened . . . specified as "the preferred rubber" in conveyor covers, shoe soles, typewriter rolls, chute linings, and many other end products. To prove the point, Goodrich-Gulf production facilities are being more than doubled to keep pace with demand.

In *your* products, use the preferred rubber . . . Ameripol.

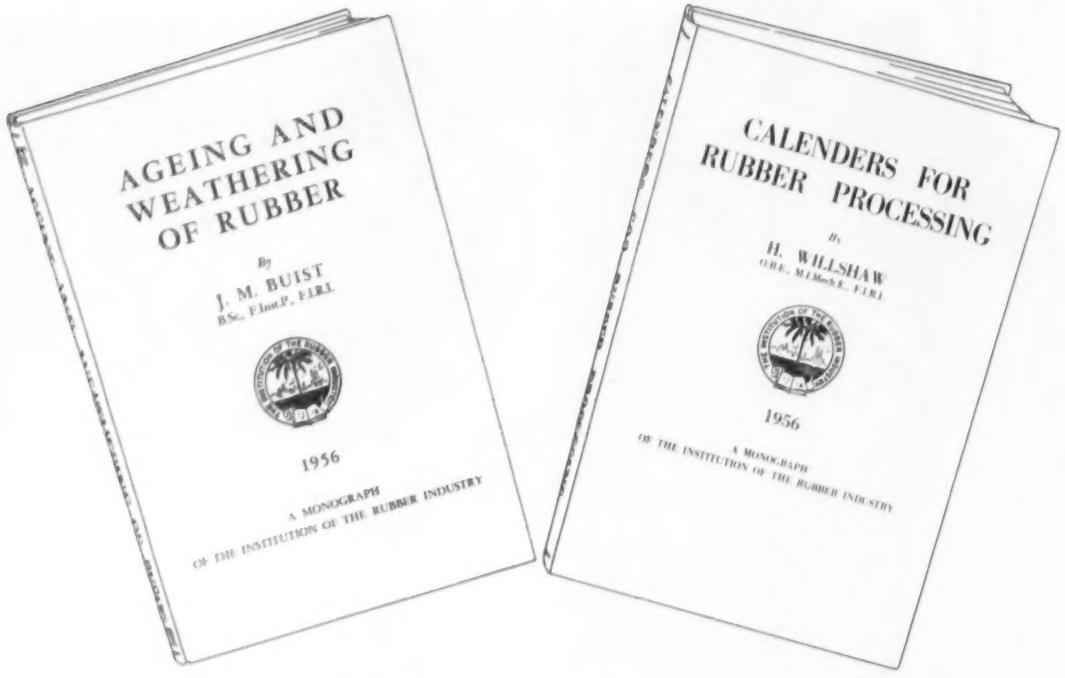
Ameripol RUBBER

Cold Non-Oil Polymers
•
Cold Oil-Extended Polymers
•
Hot Non-Oil Polymers

Goodrich-Gulf Chemicals, Inc.
3121 Euclid Avenue • Cleveland 15, Ohio

THE NAME TO REMEMBER FOR QUALITY BACKED BY YEARS OF RESEARCH AND EXPERIENCE

Two Valuable New Monographs for the Rubber Industry



AGEING AND WEATHERING OF RUBBER—by J. M. Buist. This monograph, prepared under the auspices of the Institution of the Rubber Industry, London, England, is intended as a guide to the theory and practice of the aging and weathering of rubbers. Excellent progress has been made in recent years to improve the older techniques for studying this problem. Several refinements, which have enabled more reproducible results to be obtained, throw new light on how the degradation of rubber proceeds. The newer test methods present their own problems of interpretation, and the field of testing remains full of interesting and exciting research problems. Price: $4.00.

CALENDERS FOR RUBBER PROCESSING—by H. Willshaw. Also prepared under the auspices of the Institution of the Rubber Industry, this monograph describes the uses and developments of calenders in a manner that will appeal to all classes of persons engaged in the rubber industry. The discussion covers such subjects as calender design, types of calenders, ancillary equipment, roll contours, uses in production, and other pertinent information. This monograph has been compiled from the experiences of many persons engaged in the rubber industry. It is a full yet concise discussion complete with illustrations and a handy glossary which makes the volume of even greater value to the reader. Price: $4.00.

Still Available: PNEUMATIC TYRE DESIGN—by E. C. Woods. Still another monograph in the IRI series. A valuable addition to any rubber library. Price: $3.50.

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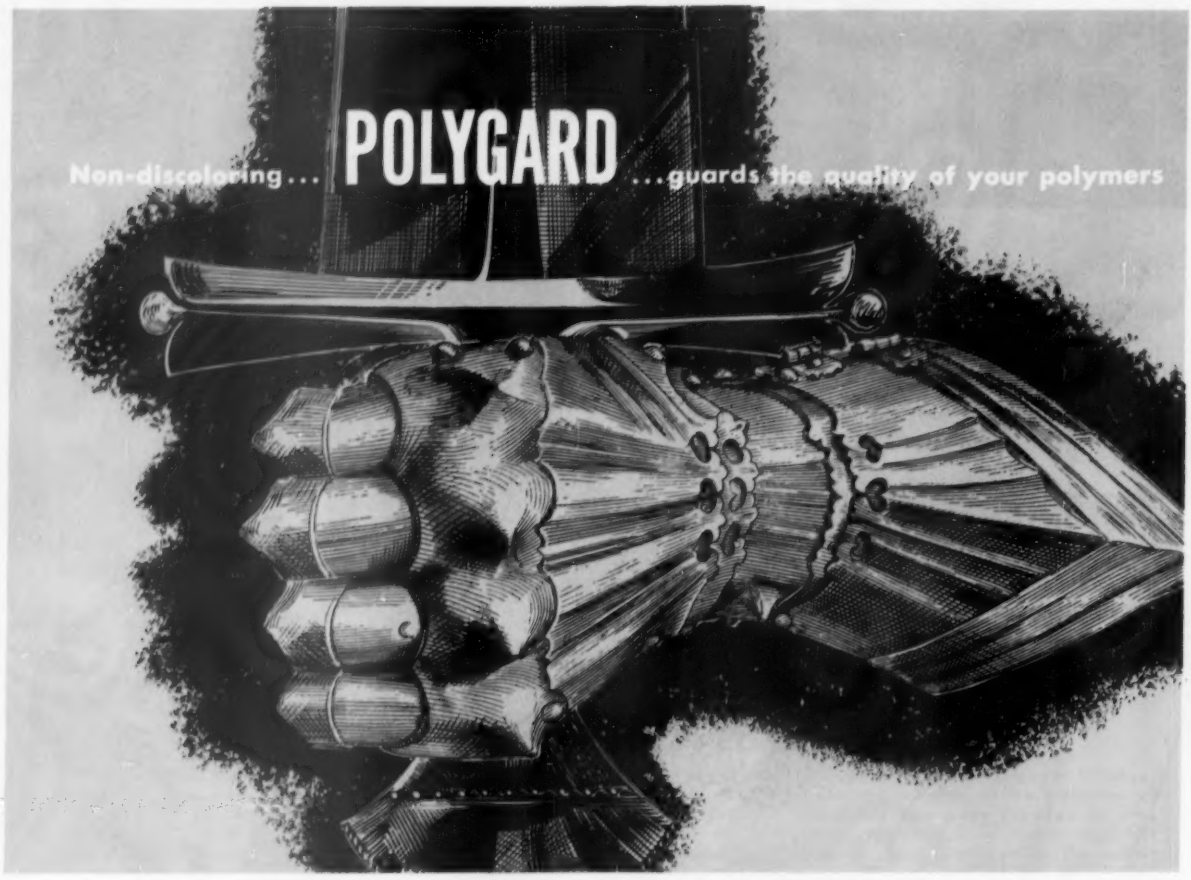

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Rubber Age

Vol. 80, No. 2 NOVEMBER, 1956

Properties of Silicone Modified Rubbers

By ELLIS H. PHREANER

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THE addition of silicone oils to conventional rubber compositions modify the products to give unique qualities. For this reason the term "silicone modified rubber" was first coined to designate these rubbers and has since been generally accepted. The term "SMR" will be used in this and subsequent papers as referring to compositions of organic rubbers containing dihydrocarbon-substituted polymeric siloxanes.

While there have been numerous papers on silicone rubbers and on the use of silicones as mold lubricants, the available published data on the use of silicones as additives to conventional rubber compositions is limited *(1-7)*.

Silicones have assumed such commercial importance, and the organic-substituted siloxanes now included in the term are so diverse in chemical make-up and in molecular structure, that attention must be called to the narrowly limited class of silicones referred to in this work.

The thermally stable dihydrocarbon-substituted polymeric siloxane chains may be formally represented as:

where R represents an alkyl or aryl hydrocarbon group. Other silicones, such as the resins having R:Si ratios of less than 2:1, are not chain structures and these and other polymeric siloxanes do not function as do the particular dihydrocarbon-substituted silicones above described. This is apparent when certain qualities of orientation affecting the inter-surface relation of these silicone chains to fillers and to organic elastomers are understood.

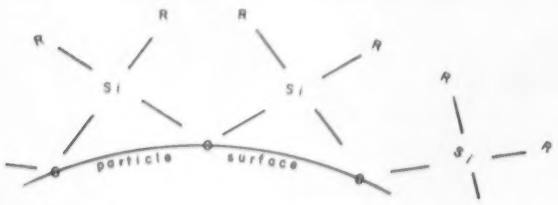
The Si-O bond is highly polar. In fact, it is semi-ionic in character, thus setting up forces of attraction which materially affect the oriented configuration of the silicone chain in relation to filler surfaces and even to water *(8)*. The dihydrocarbon-substituted polymeric siloxane molecule when subjected to orientation forces may be formally represented as:

It thus becomes apparent that these particular silicones have a quality of orientation which produces surface structures and inter-surface bonds not attainable by the cross-linked resinous silicone structures and which, because of the uniformity of distribution of the polar forces throughout the entire length of the siloxane chain, are unique as compared to the structural orientations of other surface active agents.

Note from the Editor...

Ellis H. Phreaner, author of this article, is currently engaged as a full time consulting chemist to the Stoner Rubber Company, a division of the Carlisle Tire & Rubber Co. As a result of his investigations on Silicone Modified Rubbers he received U. S. Patent No. 2,720,495 on "Rubber-Filler-Silicone Compounds and Their Manufacture" under date of October 11, 1955. The Linde Air Products Co., a division of the Union Carbide & Carbon Corp., carried on extensive laboratory tests on SMR during the 1952-54 period, both in the Akron laboratories of V. L. Smithers and at its own laboratories in Tonawanda, N. Y. All of this work was performed under the direction of Mr. Phreaner as a consultant, thus continuing the investigations he launched in 1945. Mr. Phreaner's connection with the Stoner Rubber Co. continues and he is currently engaged in research and development work on the processes covered by his patent and in the production of silicone-coated fillers. Permission to use data from tests conducted by Stoner Rubber and Linde Air Products, as well as that of other laboratories, is gratefully acknowledged by the author and the publishers.

For example, there is good evidence to support the assumption that by suitable means of dispersion on fillers, a silicone molecular oriented filler surface is formed which may be represented as:



The Si-O part of the silicone molecule becomes firmly bonded to the filler surface, and the silicone thus oriented forms a new filler particle surface of tightly packed, caterpillar hairlike organic groups.

It has been established that this silicone surface cannot be removed by solvents with which the silicone oils are completely miscible, indicating not only physical but chemical bonds *(9)*, and that fillers so treated are rendered completely hydrophobic and have improved dispersion qualities when compounded with organic polymers. Furthermore, this water repellent quality has the stability to resist heat and oxidation, notable in the silicones themselves.

Notable Variations

When SMR compositions are compounded using this oriented silicone-filler dispersion, the physical qualities of these silicone modified rubbers are materially different in a great many respects from the same rubber formulations using silicone-filler mixtures which do not provide this type of silicone-filler or rubber-silicone-filler inter-surface bond potentials.

Good dispersion, except as oriented filler coatings, of these silicones in the rubber matrix is extremely difficult, due to the lubricity of the discrete, three dimensional mass of silicone molecules. They can be brought into the rubber composition by merely mixing simultaneously with fillers, but dispersion is very poor, the silicones persisting in the rubber as discrete masses even after curing.

TABLE I—MOONEY VISCOSITIES OF PARACRIL C-HI-SIL 202 COMPOSITIONS AT 40 VOLUME LOADING

	1A	1B	1C	1D
Plasticizer	None	DOP	DOP	LM3
Amounts (Parts)	—	15	30	6.5
No. of Tests	3	3	3	8
Average Mooney	127	107	76	82

A great deal of the work of the past years has been devoted to the relation of silicone oils to fillers, and to the kind and degree of dispersion obtainable in rubber compositions. From this has come the conviction that most of the benefits in improved qualities of SMR depend quite largely on the selection of the particular silicone and on this inter-surface relation of rubber-silicone-and-filler. The conception of an oriented "silicone-bridge" between filler surface and organic elastomer chain presents an interesting and stimulating conjecture, particularly in view of the great stability of this bridge. It is not just "anchored" by a single polar group but has a continuity of structure and multiplicity of bonds.

The SMR qualities that have been studied are limited, although the experimental work was extensive. It will be readily understood that considering the complex system composed of elastomers of great variety, fillers of various chemical and physical qualities (modified by the presence of impurities), curing systems, antioxidants, and other plasticizers, it will take much evaluation work by many experimenters to more fully determine the properties of SMR. It is hoped that this paper may stimulate such work.

Properties and Compounding

The properties to be discussed have been demonstrated for specific formulations only. *Many of these qualities do not apply to SMR except for these specific or similar types of compositions.* For example: High retention of

ASTM METHODS USED

D-926-47-T Plasticity and Recovery of Rubber and Rubber-Like Materials by the Parallel Plate Plastometer (Tentative)

D-927-49-T Viscosity of Rubber and Rubber-Like Materials by the Shearing Disk Viscometer (Tentative)

D-412-49-T Tension Testing of Vulcanized Rubber (Tentative)

D-676-49-T Indentation of Rubber by Means of a Durometer (Tentative)

D-624-48 Tear Resistance of Vulcanized Rubber

D-395-49-T Compression Set of Vulcanized Rubber (Tentative)

D-573-48 Aging, Accelerated, of Vulcanized Rubber by the Oven Method

D-865-50-T Aging, Heat, of Vulcanized Natural or Synthetic Rubber by Test Tube Method (Tentative)

D-746-44-T Brittle Temperature of Plastics and Elastomers (Tentative)

D-257-49-T Electrical Resistance of Insulating Materials (Tentative)

tensile and elongation following 300° F. aging have been demonstrated for nitrile rubber compositions only when reinforced with non-black fillers and with Tuad cures. The compounder, due to the high regard in which silicones are held, is usually led to expect qualities from SMR which have not been obtained when relatively small quantities of silicone oils are added to rubber formulations. For example, low temperature qualities show little improvement and this is only demonstrated after the compositions are aged. Some of the things silicone modification will not do have been given prominent mention.

A number of the hydrocarbon-substituted silicone oils have been tested and the qualities of the rubber compositions showed marked differences due to the kind of organic substitutions employed and to other qualities of these oils. From variously substituted silicone oils, two were developed as giving the best dispersion qualities and the best unaged and aged physicals.

These silicone oils, produced by the Silicone Division of Union Carbide and Carbon, are designated as Linde Modifiers 1 and 3 (LM1 and LM3), LM3 being the best general purpose material. In formulations throughout this paper the designations LM3 and LM1 will be used. A list of all compounding materials used in the various tests as well as the ASTM methods employed accompanies the paper.

Linde Modifiers (LM), in amounts of from one-third to one-fifth of the normal amounts used, are effective as plasticizers. Mill and Banbury dispersion is improved and mixing time and power consumed are reduced. This is particularly true when compared with the mill compounding of compositions requiring relatively large amounts of liquid plasticizers. In some compositions, stickiness and difficult milling problems are overcome. Scorch and bin aging are reduced.

While LM facilitates compounding and benefits dispersion, the best mixing technique is not attainable without experience with the particular filler and elastomer. The best form of silicone-coated filler—a water slurry dispersion in the form of a dry but very friable cake—disperses rapidly on the mill or in the internal mixer. Cake form reduces filler bulk and mixing is much less dusty than when dry powdered fillers are used. Low milling temperatures are preferable.

Plasticity

Table I compares Mooney viscosities of Hi-Sil 202-Paracril C compositions with 40 volumes (78 parts by weight) loading, containing no plasticizer, 15 and 30 parts DOP, and 6.5 parts LM3 dispersed by the water slurry process. Mooney viscosities MS4′/212°F. are shown. It will be seen that 6.5 parts LM3 gives better plasticity than 15 parts DOP and nearly as good as 30 parts DOP.

TABLE II—WILLIAMS PLASTICITY AND RECOVERY OF PARACRIL C-HI-SIL 202 COMPOSITIONS AT 40 VOLUME LOADING

Plasticizer	2A None	2B DOP	2C DOP	2D Paraplex G-25	2E LM3	2F LM1
Amount (Parts)	——	15	30	30	6.5	6.5
No. of Tests...	3	3	3	3	3	3
Plasticity No...	1078	992	857	940	749	761
Recovery No...	104	29	24	34	154	138

MATERIALS AND SUPPLIES USED

Product	*Type*	*Source*
	Elastomers	
Chemigum N3	Butadiene-acrylonitrile	Goodyear
Chemigum N6	Butadiene-acrylonitrile	Goodyear
GR-S 101	Butadiene-styrene	RFC
Hycar 1042	Butadiene-acrylonitrile	Goodrich Chemical
Hycar 4021	Copolymer of an acrylic acid ester and a halogen-containing derivative	Goodrich Chemical
Hycar 1312	Low molecular weight butadiene-acrylonitrile copolymer	Goodrich Chemical
Neoprene Type W	Non-sulfur modified polychloroprene	DuPont Elastomer
Paracril C	Butadiene-acrylonitrile	Naugatuck Chemical
Paracril AJ	Butadiene-acrylonitrile	Naugatuck Chemical
	Fillers	
Hi-Sil	Fine particle precipitated silica	Columbia-Southern
Statex 125 (SAF)	Furnace carbon black	Columbian Carbon
Sterling S (SRF)	Furnace carbon black	Cabot
Spheron (MPC)	Channel black	Cabot
	Plasticizers	
DOP	Dioctyl phthalate	Union Carbide Goodrich
Light Circo Oil	Light naphthenic petroleum product	Sun Oil
LM1-LM3	Thermally stable dihydrocarbon-substituted polymeric siloxane	Union Carbide
Paraplex G-25	High molecular weight polyester	Rohm & Haas
Flexol R2H	High molecular weight polyester	Union Carbide
TOF	Trioctyl phosphate	Union Carbide
Vultrol	N-nitroso-diphenylamine	Goodrich Chemical
	Antioxidants	
Agerite Resin D	Polymerized trimethyl dihydroquinoline	R. T. Vanderbilt
B-L-E	Reaction product of diphenylamine and acetone	Naugatuck Chemical
Neozone A	Phenylalphanapthylamine	DuPont Elastomer
Thermoflex A	25% diparamethoxy diphenylamine; 25% diphenylparaphenylenediamine, and 50% phenylbetanapthylamine	DuPont Elastomer
	Curing Agents	
Methyl Tuads	Tetramethyl thiuram disulfide	R. T. Vanderbilt
Maglite D	Light calcined magnesium oxide	Marine Magnesium
NA-22	2-Mercaptoimidazoline	DuPont Elastomer
Santocure	N-cyclohexyl-2-benzothiazole sulfenamid	Monsanto Chemical
Tetrone A	Dipentamethylene thiuram tetrasulfide	DuPont Elastomer
Trimene Base	Triethyl trimethylene triamine	Naugatuck Chemical

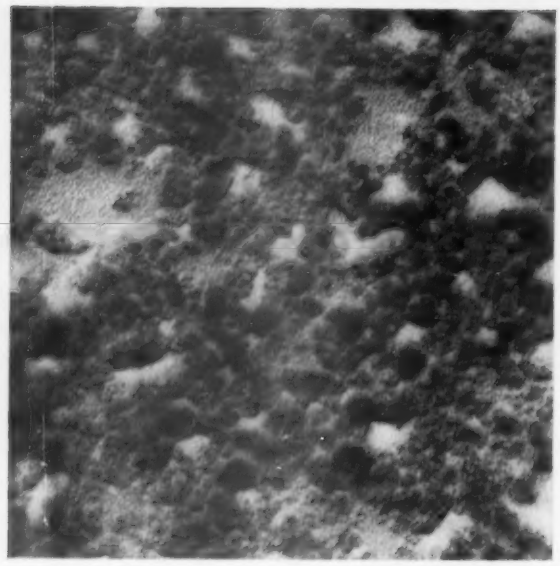


FIG. 1—Electron micrograph of a solvent dispersion of a silicic fine particle filler at 40 volume loading in Paracril C. (86,800X).

Table II compares Williams plasticity and recovery numbers for Hi-Sil 202-Paracril C compositions with 40 volumes (78 parts) loading, with no plasticizer, with 15 and 30 parts DOP, with 30 parts Paraplex G-25, and with 6.5 parts LM water slurry filler dispersion. The addition of 6.5 parts LM gave improved plastic flow over the compositions plasticized with DOP or Paraplex G-25. Silicone modification actually increased the recovery numbers, even over the unplasticized stocks. This unique quality of SMR, together with good mold flow, gives freedom from flow marks and excellent "knit," desirable factors in molding nitrile rubbers. In tubed stocks, it gives an increase over "die" dimensions.

It is recognized that plasticizers, particularly in Hi-Sil 202-nitrile rubber compositions at high loadings, are necessary to provide for the milling and molding of these stocks, as well as for modulus and hardness control. The use of smaller amounts of silicone modifiers accomplishes the same purpose, with much less degradation of physical qualities, particularly after aging.

The effect of silicone modification on dispersion is illustrated in nitrile rubber or polyacrylic compositions containing 40 to 80 volumes of Hi-Sil 202. These silicone modified rubbers have excellent transparency. At 80 volumes (156 parts) Hi-Sil 233 loading, Paracril C compositions containing 17.5 parts LM3 are transparent and mill, mold, calender and extrude well. The electron micrograph of a solvent dispersion of a silicic fine particle filler at 40 volume loading in Paracril C, shown in Figure 1, demonstrates filler particle size in the order of 10 to 20 millimicrons.

The work of other laboratories as to these dispersion qualities is also of interest. In a test comparing Hi-Sil 202-Paracril C compositions plasticized with LM3 versus Paraplex G-25, Naugatuck Chemical reported: "It was found that four times as much Paraplex G-25 as LM3 Silicone Oil was required for equivalent Mooney Viscosity, cured hardness and unaged tensile properties. Note the slightly lower Mooney Viscosity for the LM3 compound (4.35 parts) compared with 23.4 parts of Paraplex G-25. The LM3 stock is somewhat safer than the others."

In an evaluation of polyacrylic compositions reinforced with LM3-coated Hi-Sil 202, 3.24 and 7.1 parts of LM3 on 40 parts by weight of filler, compared with a control without plasticizer, the B. F. Goodrich Chemical Company Avon Lake Experiment Station reported: "From a processing standpoint, the coated fillers were considerably better, giving better tack, dispersion, and shorter incorporation times."

From an outside test evaluating 20 and 40 volumes of

TABLE III—UNAGED PHYSICALS OF PARACRIL C-HI-SIL 202 COMPOSITIONS AT 40 VOLUME LOADING

	3A	3B	3C	3D	3E	3F	3G
Paracril C	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Hi-Sil 202	78.00	78.00	78.00	78.00	78.00	78.00	78.00
LM1	—	6.50	—	13.00	—	—	—
LM3	—	—	6.50	—	13.00	—	—
DOP	—	—	—	—	—	30.00	—
Paraplex G-25	—	—	—	—	—	—	30.00
Zinc Oxide	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Stearic Acid	.50	.50	.50	.50	.50	.50	.50
Vultrol	.25	.25	.25	.25	.25	.25	.25
Thermoflex A	.75	.75	.75	.75	.75	.75	.75
Agerite Resin D	.50	.50	.50	.50	.50	.50	.50
Methyl Tuads	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Santocure	1.75	1.75	1.75	1.75	1.75	1.75	1.75
Tetrone A *	.25	.25	.25	.25	.25	.25	.25
Unaged Physicals—Cure 60′ @ 287°F.							
Modulus 300%	1480	870	780	630	605	600	740
Tensile	3380	2960	2870	2810	2720	2430	2360
Elongation (%)	605	650	660	595	620	705	565
Shore Hardness	90	76	75	73	72	72	78
Crescent Tear	415	580	550	505	540	215	205
Set at Break (%)	38	21	24	27	29	32	38
Compression Set—22 Hours @ 158°F.							
Method A (%)	14	8	10	11	13	26	17
Method B (%)	31	14	19	17	20	51	47

* The addition of Tetrone A improves recovery, but gives poor 300°F. oven aging. Its use was discontinued in subsequent tests.

Hi-Sil 202, with 2.75 and 5.5 parts respectively of LM3, and 7.5 and 15 parts light process oil, with Neoprene Type W, it was reported: "LM3-coated Hi-Sil 202 stocks possessed greater ease of mixing and improved appearance at 40-vol. loading level. The use of the silicone-coated Hi-Sil 202 did not reduce the mixing time over that required for the controls containing Hi-Sil 202 plus process oil. A pronounced improvement in smoothness of the uncured stock was observed at the 40 vol. loading of the coated Hi-Sil, although no improvement was noted at the 20 vol. level."

Effect on Cure

Linde Modifiers have no retarding effect on cure; in fact, the slurry coating of certain silicic fillers helps to overcome their retarding effect. As the superior heat resistance of SMR with the complete non-volatility of the silicone modifier eliminates the degrading effect of overcure, this affords the opportunity to improve permanent set qualities by post cure aging.

TABLE IV—UNAGED PHYSICALS OF PARACRIL C-HI-SIL 233 COMPOSITIONS AT 60 AND 80 VOLUME LOADINGS

	4A	4B	4C
Paracril C	100.00	100.00	100.00
Hi-Sil 233	117.00	117.00	156.00
LM3	13.00	—	17.50
DOP	—	40.00	—
Zinc Oxide	5.00	5.00	5.00
Stearic Acid	.50	.50	.50
Thermoflex A	.75	.75	.75
Agerite Resin D	.50	.50	.50
Methyl Tuads	2.50	2.50	2.50
Santocure	1.75	1.75	1.75
Unaged Physicals—Cure 60′ @ 300°F.			
Modulus 300%	1210	1040	1380
Tensile	2250	1980	2010
Elongation (%)	600	595	560
Shore Hardness	89	89	92
Crescent Tear	650	265	755
Set at Break (%)	45	67	60
Compression Set—22 Hours @ 158°F.			
Method A (%)	15	32	21
Method B (%)	28	64	36

TABLE V—UNAGED PHYSICALS OF PARACRIL C-HI-SIL 233 COMPOSITIONS AT 40 VOLUME LOADING

	5A	5B	5C
Paracril C	100.00	100.00	100.00
LM3	—	6.50	—
DOP	—	—	15.00
Hi-Sil 233	78.00	78.00	78.00
Zinc Oxide	5.00	5.00	5.00
Thermoflex A	.75	.75	.75
Agerite Resin D	.50	.50	.50
Vultrol	.25	.25	.25
Methyl Tuads	2.50	2.50	2.50
Santocure	1.75	1.75	1.75
Unaged Physicals—Cure 60′ @ 287°F.			
Modulus 100%	460	340	250
200%	890	420	410
300%	1470	680	720
Tensile	3720	3290	2560
Elongation (%)	625	725	700
Shore Hardness	84	81	79
Crescent Tear	575	590	430

TABLE VI—UNAGED PHYSICALS OF HYCAR 1042-CARBON BLACK COMPOSITIONS

	6A	6B	6C	6D
Hycar 1042	100.00	100.00	100.00	100.00
LM3	4.50	—	3.40	—
DOP	—	20.00	—	15.00
SAF (Statex 125)	40.00	40.00	—	—
SRF (Sterling S)	—	—	65.00	65.00
Zinc Oxide	5.00	5.00	5.00	5.00
Stearic Acid	.50	.50	.50	.50
Vultrol	.25	.25	.25	.25
Methyl Tuads	2.50	2.50	2.50	2.50
Santocure	1.75	1.75	1.75	1.75
Unaged Physicals—Cure 60′ @ 287°F.				
Modulus 100%	180	150	220	130
200%	450	250	610	300
300%	920	460	1010	600
Tensile	3080	1600	2110	1860
Elongation (%)	645	665	635	780
Hardness	61	51	62	52
Crescent Tear	270	180	310	225

TABLE VII—UNAGED PHYSICALS OF GR-S-CARBON BLACK COMPOSITIONS

	7A	7B	7C
GR-S-101	100.00	100.00	100.00
LM3	—	—	5.00
Light Circo Oil	—	5.00	—
MPC (Spheron)	50.00	50.00	50.00
Stearic Acid	1.50	1.50	1.50
Zinc Oxide	5.00	5.00	5.00
BLE	1.00	1.00	1.00
Sulfur	1.92	1.92	1.92
Santocure	1.25	1.25	1.25
Unaged Physicals—Cure 60′ @ 287°F.			
Modulus 100%	180	170	150
200%	440	400	240
300%	1020	860	610
Tensile	3420	3180	3250
Elongation (%)	640	645	730
Shore Hardness	63	58	57

Physical Qualities of Unaged SMR

It will be noted from Tables III to IX, inclusive, that moderate additions of silicone oils were effective in reducing modulus and that this was accomplished without the serious reduction in tensile strength that occurred when the larger amounts of other plasticizers, which are necessary to give corresponding reductions in stiffness, were used.

Tear resistance for the silicone modified rubbers was high, in some cases improved over the unplasticized compositions and considerably better than where other plasticizers were used. Recovery, as indicated by set at break and compression set methods A and B, was benefited by the use of silicone-coated fillers.

The silica-reinforced polyacrylic-silicone modified rubbers of Table IX show modulus, hardness and tensile increase, and elongation decrease, as compared with the control composition without plasticizer addition. This marked reinforcing may be due, in this particular formulation, to cross-linking between the filler oriented, bonded silicone chain and the elastomer.

Silicone-coated Hi-Sil in Kel-F Elastomer has been shown *(7)* to increase modulus, hardness, tear strength and tensile with a slight reduction of elongation, in comparison with control compositions without plasticizer. It is theorized that in these compositions there is a cross-

TABLE VIII—UNAGED PHYSICALS OF NEOPRENE-HI-SIL 202 COMPOSITIONS

	8A	8B
Neoprene Type W	100.00	100.00
LM3	—	5.50
Light Circo Oil	15.00	—
Hi-Sil 202	63.40	63.40
Stearic Acid	0.50	0.50
Zinc Oxide	5.00	5.00
Maglite D	4.00	4.00
Neozone A	2.00	2.00
NA22	0.50	0.50
Unaged Physicals—Cure 20′ @ 307°F.		
Modulus 200%	950	1050
400%	2000	1800
Tensile	2900	2975
Elongation (%)	640	720
Shore Hardness	71	81
Compression Set—Method B		
22 hrs. at 158°F. (%)	66.5	41.2
70 hrs. at 212°F. (%)	91.9	68.0

TABLE IX—UNAGED PHYSICALS OF POLYACRYLIC-HI-SIL COMPOSITIONS

	9A	9B	9C
Hycar 4021	100.00	100.00	100.00
LM3	3.24	7.10	—
Hi-Sil 233	40.00	40.00	40.00
Stearic Acid	1.00	1.00	1.00
Trimene Base	3.00	3.00	3.00
Sulfur	0.50	0.50	0.50
Unaged Physicals—Cure 30′ @ 310°F.			
Modulus 300%	690	550	475
Tensile	1700	1675	1290
Elongation (%)	520	570	740
Shore Hardness	66	58	60
30′ Tensile Sheets Tempered 24 hours at 300°F.			
Modulus 300%	1475	1070	950
Tensile	1800	1675	1500
Elongation (%)	340	400	530
Shore Hardness	79	72	70

TABLE X—UNAGED PHYSICALS OF CHEMIGUM N6-HI-SIL CO-COAGULATED COMPOSITIONS*

	10A	10B
Chemigum N6	100.00	100.00
LM3	4.00	3.65
Hi-Sil 233	40.00	36.50
Stearic Acid	.50	.50
Zinc Oxide	1.00	1.00
Methyl Tuads	2.75	2.75
Santocure	1.75	1.75
Unaged Physicals—Cure 60′ @ 287°F.		
Modulus 200%	405	430
300%	740	750
Tensile	3300	3200
Elongation (%)	575	580
Shore Hardness	69	68

* A water slurry dispersion of LM3 silicone oil and Hi-Sil 233 was co-coagulated with the Chemigum N6 latex. The dried coagulum was mill compounded with the balance of the formula.

linking between the silicone polymer and the fluorocarbon polymer.

The co-coagulation of a water slurry dispersion of silicone oils and fillers with rubber latices offers interesting possibilities. Table X, showing unaged physicals of two such compositions, demonstrates excellent reinforcing with low loadings of Hi-Sil.

Heat Aging

Dimensional Stability: There is no appreciable loss of LM1 and LM3 in circulating air oven aging within the range of temperature at which the organic rubbers, including polyacrylic and Kel-F Elastomer, are of practical use.

Figures 2 and 3 illustrate qualities of dimensional stability for circulating air oven aging. Table XI gives weight and volume losses of a considerable number of compositions for circulating air oven aging at 250° and

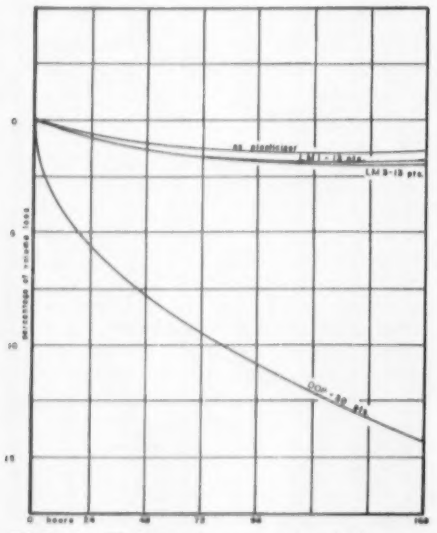


FIG. 2—Volume loss on circulating air oven at 250°F.

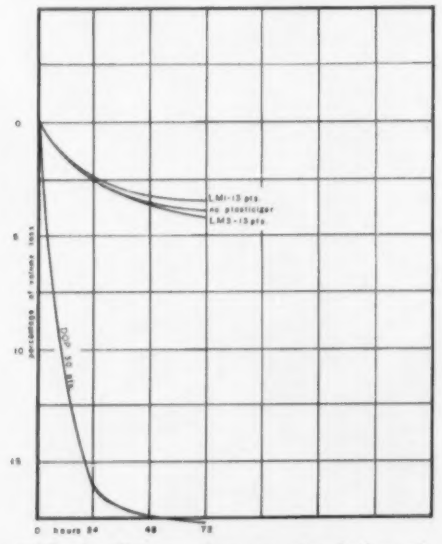


FIG. 3—Volume loss on circulating air oven at 300°F.

TABLE XI—% WEIGHT AND VOLUME LOSS ON CIRCULATING AIR OVEN AGING

Elastomer	Filler	Amount (Volume)	Plasticizer	Amount (Parts)	Aging Period Hours/Temperature in °F. 96/250° Wt.	96/250° Vol.	168/250° Wt.	168/250° Vol.	72/300° Wt.	72/300° Vol.	10/400° Wt.	10/400° Vol.
Nitrile Rubber	Hi-Sil	40	None	—	2.45	1.70	2.65	2.15	3.40	3.53	—	—
	Hi-Sil	40	DOP	30	8.85	10.07	13.20	16.40	14.70	18.17	—	—
	Hi-Sil	40	Paraplex G-25	30	2.31	2.61	—	—	—	—	—	—
	Hi-Sil	40	Trioctyl Phosphate	30	12.60	16.20	—	—	—	—	—	—
	Hi-Sil	40	LM1	13	2.23	1.68	—	—	2.92	2.58	—	—
	Hi-Sil	40	LM3	6.5	2.51	1.72	—	—	3.09	3.54	2.76	2.02
	Hi-Sil	40	LM3	13	2.45	2.00	—	—	2.86	3.64	—	—
	Hi-Sil	40	LM3	19.5	2.69	1.82	—	—	3.45	3.82	—	—
	Hi-Sil	40	LM3	30	2.44	1.49	—	—	2.98	2.99	—	—
	HAF Black	30	DOP	20	6.87	—	—	—	—	—	—	—
	HAF Black	30	LM3	5.0	0.91	—	—	—	—	—	—	—
GR-S	MPC Black	27	None	—	0.81	—	—	—	—	—	—	—
	MPC Black	27	Circo Light Oil	5.0	3.16	—	—	—	—	—	—	—
	MPC Black	27	LM3	5.0	1.29	—	—	—	—	—	—	—
Polyacrylic	Hi-Sil	20	None	—	—	—	—	—	11.30	—	—	—
	Hi-Sil	20	LM3	3.25	—	—	—	—	1.70	—	—	—
	Hi-Sil	20	LM3	7.0	—	—	—	—	1.80	—	—	—

Note: % loss figured on unaged weight or volume at atmospheric humidity.

300° F. It is shown that the silicone modified compositions have weight and volume losses closely paralleling the control compositions without plasticizer.

Retention of Elongation and Tensile: Resistance to air aging at high temperatures of a few selected SMR compositions offers the opportunities to utilize certain qualities of the nitrile rubbers for applications at temperatures which have generally been considered too high for these organic rubbers. However, experience with nitrile compositions has demonstrated that really satisfactory retention of elongation and tensile for 300°F. air aging is only attainable for compositions with Tuad cures, with non-black fillers, and with the aid of heat-resistant antioxidants. Such compositions show consistent reproducible retention of elongations in excess of 200%, and of tensiles above 1600 p.s.i., following air oven or test tube aging for 70 hours at 300° F. Polyacrylic compositions reinforced with silicone-coated Hi-Sil have demonstrated similar elongation and tensile retention after circulating air aging for 70 hours at 350° F.

Circulating air aging either by the oven or test tube method is a phenomena of surface oxidation of the rubber specimen. As the aging progresses, the dumbbell shaped test piece attains a hard, brittle surface layer. The depth of this oxidized surface, and the ratio of the oxidized surface to the less affected rubber below the surface, increases with time of exposure and with the amount of air present.

In stress-strain testing, the oxidized surface breaks at a low elongation, leaving the inner unaffected portion, now much reduced in area, to bear the load. In any use where the rubber part is less exposed to air, due to the shape or thickness of the part, to immersion in oil, or with the whole or partial exclusion of air, as with the presence of inert gases, the useful life of the part at test temperatures, or even higher temperatures, will be much longer than would be indicated by our highly accelerated circulating air test methods.

Under such less severe conditions of air exposure, silicone modified nitrile rubber pads and membranes have been used for periods of 1,000 hours at temperatures of 300° to 325° F., and are still rubberlike and functioning.

TABLE XII—EFFECT OF CIRCULATING AIR OVEN AGING ON PARACRIL C-HI-SIL 233 COMPOSITIONS AT 40 VOLUME LOADING AT 250° AND 300°F.

	12A	12B	12C	12D	12E
Paracril C	100.00	100.00	100.00	100.00	100.00
Hi-Sil 233	78.00	78.00	78.00	78.00	78.00
LM3	—	6.50	13.00	—	—
DOP	—	—	—	15.00	30.00
Zinc Oxide	5.00	5.00	5.00	5.00	5.00
Stearic Acid	.50	.50	.50	.50	.50
Thermoflex A	.75	.75	.75	.75	.75
Agerite Resin D	.50	.50	.50	.50	.50
Methyl Tuads	2.50	2.50	2.50	2.50	2.50
Santocure	1.75	1.75	1.75	1.75	1.75
Unaged Physicals—Cure *60'* @ 287°F.					
Modulus 200%	870	420	290	310	270
300%	1400	690	480	540	460
Tensile	3470	3270	3100	2490	2120
Elongation (%)	620	795	780	790	840
Hardness	86	80	76	71	69
Crescent Tear	525	570	545	390	280
Circulating Air Oven Aged *96 hours at 250°F.*					
Modulus 200%	1750	860	570	820	720
300%	2570	1220	910	1150	1010
Tensile	3010	3410	3290	2060	1920
Elongation (%)	370	650	660	540	575
Hardness	90	86	83	89	86
Crescent Tear	370	590	495	285	265
48 hours at 300°F.					
Modulus 200%	—	780	660	—	—
300%	—	1660	1240	—	—
Tensile	2120	3280	3040	1360	1240
Elongation (%)	90	455	510	95	110
Hardness	92	89	90	92	90
Crescent Tear	—	425	410	—	—
72 hours at 300°F.					
Modulus 200%	—	1290	1040	—	—
300%	—	1980	1700	—	—
Tensile	1790	2280	1905	790	1380
Elongation (%)	70	335	320	70	100
Hardness	92	92	90	92	90
Crescent Tear	—	380	390	—	—

TABLE XIII—EFFECT OF CIRCULATING AIR OVEN AGING ON PARACRIL C-HI-SIL 202 COMPOSITIONS AT 40 VOLUME LOADING AT 250° AND 300°F.

	13A	13B	13C	13D	13E
Paracril C	100.00	100.00	100.00	100.00	100.00
Hi-Sil 202	78.00	78.00	78.00	78.00	78.00
LM3	—	—	6.50	—	—
LM1	—	—	—	6.50	13.00
DOP	—	30.00	—	—	—
Zinc Oxide	5.00	5.00	5.00	5.00	5.00
Stearic Acid	.50	.50	.50	.50	.50
Thermoflex A	.75	.75	.75	.75	.75
Agerite Resin D	.50	.50	.50	.50	.50
Vultrol	.25	.25	.25	.25	.25
Methyl Tuads	2.50	2.50	2.50	2.50	2.50
Santocure	1.75	1.75	1.75	1.75	1.75
Unaged Physicals—Cure 60′ @ 287°F.					
Modulus 200%	770	260	280	470	250
300%	1100	390	380	860	430
Tensile	3090	1960	2410	2520	2500
Elongation (%)	720	1030	870	690	885
Hardness	90–81	80–71	73–62	76–65	74–63
Circulating Air Oven Aged					
48 hours at 250°F.					
Modulus 200%	1210	600	500	710	470
300%	1900	890	660	1220	830
Tensile	2990	1895	2600	2610	2420
Elongation (%)	460	660	750	600	760
Hardness	94–89	86–79	79–70	82–78	79–71
96 hours at 250°F.					
Modulus 200%	1840	850	690	1110	630
300%	2700	1250	1030	1650	950
Tensile	3035	1830	2555	2810	2360
Elongation (%)	340	425	650	520	690
Hardness	97–93	95–91	86–80	86–80	85–76
168 hours at 250°F.					
Modulus 200%	—	1400	840	1450	1760
300%	—	—	1200	2000	1150
Tensile	2500	1610	2425	3120	2400
Elongation (%)	170	240	600	440	630
Hardness	97–94	96–92	88–83	89–83	87–82
24 hours at 300°F.					
Modulus 200%	1690	970	620	950	600
300%	2470	1490	1080	1500	1050
Tensile	2850	2230	2680	2915	2775
Elongation (%)	350	515	675	550	685
Hardness	96–91	94–89	86–80	90–85	86–80
48 hours at 300°F.					
Modulus 200%	1980	1290	720	1200	790
300%	—	1810	1170	1780	1200
Tensile	2540	2010	2495	2860	2495
Elongation (%)	240	330	595	470	570
Hardness	96–92	96–94	88–84	94–90	88–83
72 hours at 300°F.					
Modulus 200%	—	—	870	1410	900
300%	—	—	1230	2175	1320
Tensile	2015	1580	2350	2945	2365
Elongation (%)	130	150	515	400	500
Hardness	97–94	94–90	89–83	96–92	91–87

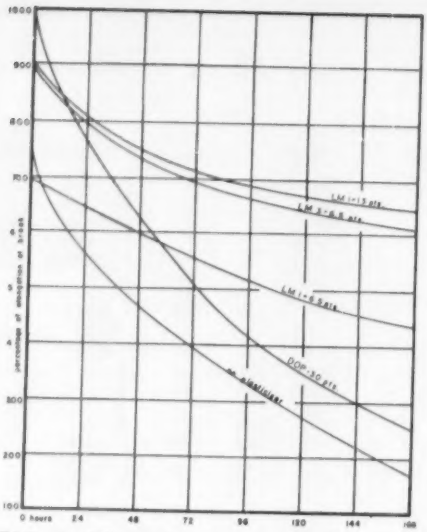


FIG. 4—Elongation loss on air oven aging at 250°F.

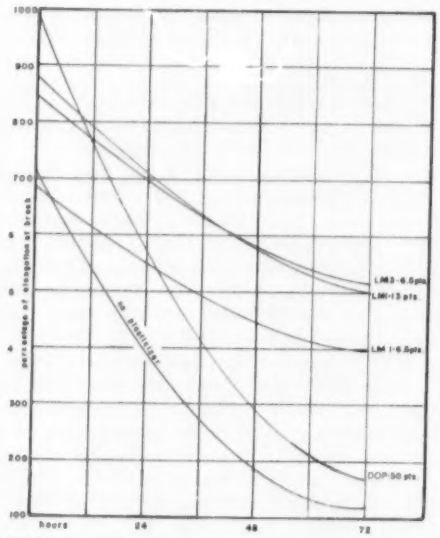


FIG. 5—Elongation loss on air oven aging at 300°F.

Circulating air aging tests on standard .085-inch dumbbell pieces of silicone modified nitrile rubber compositions at 350° to 400° F. have demonstrated elongation retention of above 150% for a number of hours. Tensile falls off more rapidly than elongation, due to the phenomena of aging and surface cracking, producing progressively a thinner cross-section area of rubber to resist the stress.

Tables XII and XIII and Figures 4, 5, and 6 illustrate the effect of silicone modification in retarding loss of elongation, of tensile and of modulus increase following circulating air oven aging at 250° and 300° F. Figures 4 and 5 show elongation loss. Figure 6 shows the change in the stress-strain curves for the unaged compositions after 72 hours aging at 300° F. The horizontal dash lines illustrate the loss of elongation of these compositions. Figure 7 illustrates rate of modulus increase for 300° F. aging.

The elongation loss and modulus increase of the DOP composition may be, in a measure, due to the volatile loss of plasticizer (illustrated in Figure 3), but it will be noted that the composition without plasticizer increased in modulus even faster than the DOP composition.

Table XIV shows the effect of adding other plasticizers to a Chemigum-Hi-Sil silicone modified rubber composition. The use of Hycar 1312, a low molecular weight butadiene-acrylonitrile copolymer, shows no adverse effect on 300° F. aged qualities, but the non-volatile polyester type plasticizer Paraplex G-25, which showed no

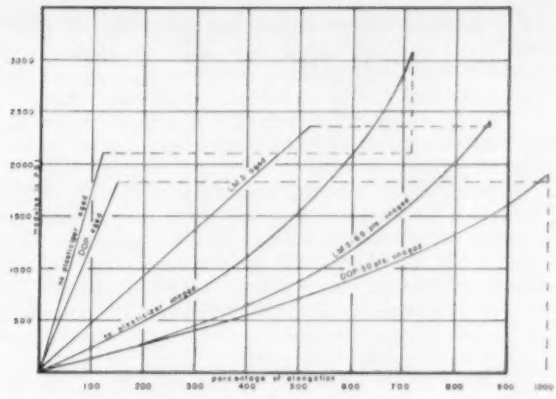


FIG. 6—Stress-strain curves for unaged compositions after 72 hours of circulating air oven aging at 300°F. (See Table XIII).

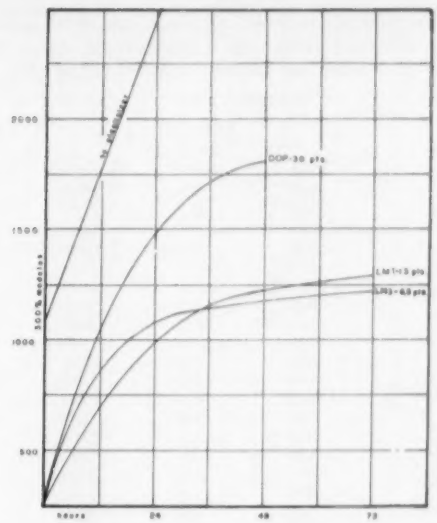


FIG. 7—Modulus increase on air oven aging at 300°F.

degrading effects following 250° F. aging, does show reduced elongation and particularly lower tensile following 300° F. aging.

Table XV demonstrates that differences in silicas can cause a degrading effect on the 300° F. heat aged properties of a Hycar 1042 composition. Experimental Silica 53JA324, which gave excellent aging, corresponds to the present Hi-Sil 233. Experimental Silica 53JA325, on the other hand, is chemically somewhat different and caused loss of properties in Hycar 1042. It is worthy of note that the latter silica did not degrade the 300° F. heat aging resistance of Paracril C.

At this point it should be emphasized that Hi-Sil 202, used extensively in the experimental work on which this report is based, has been discontinued. Hi-Sil 233, which has replaced it, gives superior SMR physical qualities and has as excellent heat aging resistance in the specific SMR compositions as was obtained with the Experimental Silica 53JA324.

Is the SMR quality of better elongation and tensile retention after circulating air heat aging reproducible? This quality has been established only for compositions closely approximating the SMR formula of Tables XII to XV. Table XVI lists the variations in quality that have occurred in a long series of tests of similar silicone modified rubbers, and demonstrates that for these compositions the variations are within the range of those which occur in all circulating air heat aging tests.

TABLE XIV—EFFECT OF CIRCULATING AIR (TEST TUBE) AGING ON CHEMIGUM-HI-SIL 233-SMR COMPOSITIONS WITH ADDITIONAL PLASTICIZERS AT 300°F.

	14A	14B	14C	14D	14E	14F
Chemigum N3	100.00	100.00	100.00	—	—	—
Chemigum N6	—	—	—	100.00	100.00	100.00
LM1	15.00	15.00	15.00	9.00	9.00	9.00
Hycar 1312	—	10.00	—	—	10.00	—
Paraplex G-25	—	—	10.00	—	—	10.00
Hi-Sil 233	45.00	45.00	45.00	48.00	48.00	48.00
Zinc Oxide	5.00	5.00	5.00	5.00	5.00	5.00
Stearic Acid	.50	.50	.50	.50	.50	.50
Agerite Resin D.	3.00	3.00	3.00	3.00	3.00	3.00
Methyl Tuads	2.25	2.25	2.25	2.40	2.40	2.40
Santocure	1.50	1.50	1.50	1.50	1.50	1.50
Unaged Physicals—Cure 60' @ 287°F.						
Modulus 200%	260	270	180	205	100	120
300%	410	405	395	365	145	195
Tensile	1980	2120	2210	2320	2040	1995
Elongation (%)	660	770	805	830	950	850
Hardness	62	57	57	68	62	60
Test Tube Aged—70 Hours @ 300°F.						
Modulus 200%	700	615	550	900	610	660
300%	1200	1130	Broke	1450	865	Broke
Tensile	1800	1515	845	1745	1615	845
Elongation (%)	405	390	245	325	395	270
Hardness	70	70	68	78	74	76

TABLE XV—EFFECT OF CIRCULATING AIR (TEST TUBE) AGING ON HYCAR 1042-HI-SIL COMPOSITIONS AT 300°F.

	15A	15B	15C
Hycar 1042	100.00	100.00	100.00
LM3	6.50	6.50	—
DOP	—	—	15.00
Experimental Silica 53JA324	78.00	—	—
Experimental Silica 53JA325	—	78.00	78.00
Zinc Oxide	5.00	5.00	5.00
Stearic Acid	.50	.50	.50
Vultrol	.25	.25	.25
Thermoflex A	.75	.75	.75
Agerite Resin D	.50	.50	.50
Methyl Tuads	2.50	2.50	2.50
Santocure	1.50	1.50	1.50
Unaged Physicals—Cure 60' @ 287°F.			
Modulus 200%	490	330	360
300%	810	540	640
Tensile	2700	2530	2350
Elongation (%)	705	795	785
Hardness	84–73	74–62	76–67
Test Tube Aged 48 hours at 300°F.			
Modulus 200%	1460	—	—
300%	2420	—	—
Tensile	2680	960	1180
Elongation (%)	335	165	145
72 hours at 300°F.			
Modulus 200%	2160	—	—
300%	—	—	—
Tensile	2400	900	960
Elongation (%)	225	40	75

TABLE XVI—RANGE OF ELONGATION AND TENSILE AFTER 72 HOURS AT 300°F. CIRCULATING AIR AGING

Formula Number	Elongation (%) Unaged	Elongation (%) After 70 to 72 hrs. at 300°F.	Tensile Unaged	Tensile After 70 to 72 hrs. at 300°F.
144	885	475	2500	2010
249	685	395	2520	2940
229	885	375	2320	2300
231	920	315	1980	1620
417	715	225	2720	2380
248	870	525	2410	2020
6271	830	327	2790	2450
448	705	235	2790	2100
461	735	295	3120	2480
463	655	245	3100	2340
24-13-1	770	300	2740	2710
44A	660	405	1980	1800
44B	770	390	2120	1515
23-13-1	940	530	2310	2230
426A	830	325	2320	1745
426B	950	395	2040	1615
445	905	335	2350	1490
4811A	570	200	3075	2600
4811A-1	660	210	2850	2250
5626 3C	740	300	2850	2710
481L	830	355	3240	2710
M1-312	895	375	2750	1790
M1-319	925	240	2900	1840
M1-329	990	315	2560	1660
M1-326	900	430	2890	2115
M1-421	1000	415	1990	1640
M1-422	995	340	2730	1620

It has been demonstrated that no consistent qualities of elongation retention at 300° F. heat aging were obtained in the following types of SMR compositions: (1) With carbon black fillers, (2) With elastomers having less heat resistant quality, (3) With silicone oil dispersion on fillers by any other than the uniform milling or water slurry dispersion processes, and (4) With any other curative systems.

Even within the range of nitrile rubber-silica-reinforced SMR compositions closely approximating the formulas of Tables XII to XIV, considerable fluctuations in heat aged qualities have occurred due to: (1) Differences in the nitrile elastomers, (2) Differences (particularly impurities) in silica filler, (3) Differences in the dispersion preparation of silicone-coated fillers, and (4) Differences in mill compounding technique.

Polyacrylic rubber compositions tested by the B. F. Goodrich Avon Lake Experiment Station, which by their kind permission are given in Table XVII, demonstrated superior qualities in tensile strength after 300 and 350° aging.

Water Absorption

At room temperature all SMR compositions have low water absorption. When silica fillers are LM3 coated by the water slurry process and salt impurities are removed from the filler by decanting, or from co-coagulated crumb by careful washing, water absorption at elevated temperatures, even for nitrile rubber compositions reinforced with silicic fillers, is as low as are the most water-resistant GR-S-black rubbers.

In dilute or concentrated salt solutions these same nitrile rubber-silicic compositions not only have low water absorption but do not absorb any of the salts, which salts do enter other rubber compositions and are found deposited there on drying.

When this phenomena of the rejection of salts by SMR rubbers was observed, the possibility of passing salt free water through a thin SMR membrane under pressure was investigated. There was no penetration of water through a .012-inch SMR membrane at a 25 or 60 pound pressure differential for a four day period, the rubber membrane being supported on filter paper in a Seitz pressure filter.

Nitrile rubber compositions reinforced with dry mill dispersion silicone-coated silicas show a steady but slow increase in water absorption at elevated temperatures until as high as 20 or 30% weight increase is attained. Even with this very high water absorption, physical qualities and particularly electrical resistance are not affected to the extent encountered in control compositions that have absorbed much less water.

In the case of water absorption by SMR silica-filled compositions, particularly those with dry mill dispersion fillers that take up so much weight increase, the rate of desorption is very much slower than for the controls.

This combination of phenomena has lead to the belief that only disassociated monomeric water molecules are taken up, or enter, these SMR compositions, and that these H-O-H monomers associate or bond themselves in the rubber with Si-O groups or chains. The ionic charges on clay particles has been suggested as establishing a non-mobile pattern of water molecular arrangement termed "rigid" water *(10)*.

Table XVIII presents data on water absorption of compositions of Paracril C reinforced with Experimental Silica 53JA324, equivalent to Hi-Sil 233. The filler for Composition 18A was prepared by the water slurry silicone oil dispersion method and was decanted to remove salt from the filler. Composition 18B was the same Hi-Sil silicone coated by the uniform dry mill dispersion method but not washed to remove salt. The control compositions used the same Hi-Sil, with DOP as the plasticizer for 18C; 18D without plasticizer. A GR-S composition with 50 parts Spheron black is used for comparison.

TABLE XVII—EFFECT OF CIRCULATING AIR HEAT AGING ON HYCAR 4021-HI-SIL COMPOSITIONS AT 300° AND 350°F.

	17A	17B	17C
Hycar 4021	100.00	100.00	100.00
Experimental Silica 53JA324	40.00	40.00	40.00
LM3	3.24	7.10	—
Stearic Acid (NBS)	1.00	1.00	1.00
Trimene Base	3.00	3.00	3.00
Sulfur	0.50	0.50	0.50
Unaged Physicals—Cure 30′ @ 310°F.			
Modulus 300%	690	550	475
Tensile	1700	1675	1290
Elongation (%)	520	570	740
Hardness	66	58	60
30′ Tensile Sheets Tempered 24 Hours @ 300°F.			
Modulus 300%	1475	1070	950
Tensile	1800	1675	1500
Elongation (%)	340	400	530
Hardness	79	72	70
Air Test Tube Aged—70 Hours @ 300°F.			
Tensile	1620	1660	625
Elongation (%)	280	350	400
Hardness	75	70	72
Air Test Tube Aged—70 Hours @ 350°F.			
Tensile	1700	1450	800
Elongation (%)	180	250	400
Hardness	83	77	75

TABLE XVIII—WATER ABSORPTION OF PARACRIL C-HI-SIL COMPOSITIONS

	18A Water Slurry Dispersion	18B Dry Mill Dispersion	18C DOP	18D No Plasticizer	GR-S-Spheron Black Comp.
Paracril C	100.00	100.00	100.00	100.00	
Experimental Silica 53JA324	60.00	60.00	60.00	60.00	
LM3 (Water Slurry Disp.[1])	5.00	—	—	—	
LM3 (Dry Mill Disp.)	—	5.00	—	—	
DOP	—	—	15.00	—	
Stearic Acid	.50	.50	.50	.50	
Zinc Oxide	1.00	1.00	1.00	1.00	
Methyl Tuads	2.75	2.75	2.75	2.75	
Santocure	1.75	1.75	1.75	1.75	
After Immersion in Distilled Water[2]					
At Room Temperature					
24 hrs.	.54	.75	8.45	7.97	.68
48 hrs.	.81	1.02	8.42	7.75	.90
72 hrs.	1.02	1.29	8.43	7.51	1.21
168 hrs.	1.25	1.78	8.21	7.71	1.80
504 hrs.	1.79	3.16	Tests discontinued		
1008 hrs.	2.09	4.20	as equilibrium absorption reached.		
At 70°C.					
24 hrs.	1.80	4.30	9.77	8.62	1.62
48 hrs.	2.05	6.28	9.89	8.66	2.96
72 hrs.	2.35	7.97	10.13	9.03	3.34
168 hrs.	3.07	12.89	10.96	9.40	—
504 hrs.	4.50	20.61	11.88	10.53	—
1008 hrs.	5.23	26.04	12.79	10.78	—
At 100°C.					
24 hrs.	2.59	10.21	9.07	7.08	—
48 hrs.	3.21	13.93	8.91	6.79	—
72 hrs.	3.59	15.30	8.25	6.54	—
168 hrs.	4.56	16.56	8.86	7.31	—
336 hrs.	5.89	10.11	Tests discontinued as		
504 hrs.	5.96	11.86	equilibrium absorption reached.		
From 2% Sodium Chloride Solution					
At Room Temperature					
24 hrs.	0.66	—	4.00	—	
90 hrs.	1.29	—	7.05	—	
At 100°C.					
24 hrs.	3.89	—	8.71	—	
90 hrs.	4.34	—	7.29	—	
From Concentrated Sodium Chloride Solution—% Weight Increase at 70°C.[3]					
44 hrs.	0.10	—	0.92	—	
From Concentrated $CuSO_4$ Solution—% Weight Increase at 70°C.[3]					
22 hrs.	1.92	—	5.10	—	
66 hrs.	3.75	—	3.76	—	

(1) Salt impurity in Hi-Sil removed by decanting after silicone addition. (2) % weight increase based on unaged weight at atmospheric humidity. (3) Analysis of the rubber compositions after drying showed no sodium chloride or $CuSO_4$ in the silicone modified rubbers, but these salts were present in the control composition.

Water Shedding

The contact angle of water with a clean abraded surface of silica-reinforced SMR is 90° or greater. The same composition without silicone modification or plasticized with DOP has a contact angle below 45°. A drop of water on the clean SMR surface is easily moved or displaced by a light jar or by holding the sample on an incline, while the drop of water clings to the control composition.

Oil Immerse Aging

Linde Silicone Modifiers LM3 and LM1 are non-extractable from rubber compositions immersed in ASTM 1, 2 or 3 oils (see Figure 8). In fact, these silicone oils when dispersed by the water slurry process to establish silicone oriented and bonded silica filler surface coatings, cannot be extracted from the fillers by leaching with solvents or with detergents.

From Figure 8 it will be noted that the weight and volume change in ASTM No. 1 closely parallels that of the composition without plasticizer, both after immersion and after severe reconditioning. The loss of DOP plasticizer is severe and 50% of this loss occurs in the first 24 hours of immersion. In ASTM No. 3, which also shows extraction of DOP on immersion, the silicone modified compositions show about 30% more swell than the composition without plasticizer and a small amount of this oil is retained after severe reconditioning.

In Table XIX the effect of oil and fuel immersion on

TABLE XIX—OIL AND FUEL IMMERSION OF PARACRIL C-HI-SIL 202 COMPOSITIONS

	19A	19B	19C	19D
Paracril C	100.00	100.00	100.00	100.00
LM3	6.50	—	—	—
LM1	—	6.50	—	—
DOP	—	—	—	30.00
Hi-Sil 202	78.00	78.00	78.00	78.00
Zinc Oxide	5.00	5.00	5.00	5.00
Stearic Acid	.50	.50	.50	.50
Vultrol	.25	.25	.25	.25
Thermoflex A	.75	.75	.75	.75
Agerite Resin D	.50	.50	.50	.50
Methyl Tuads	2.50	2.50	2.50	2.50
Santocure	1.75	1.75	1.75	1.75
Unaged Physicals—Cure 1 hour @ 287°F.				
Modulus 300%	380	860	840	240
Tensile	2410	2520	3180	1830
Elongation (%)	870	685	630	1000
Hardness	73–62	76–65	85–74	69–62
ASTM No. 1 Immersion Physicals—96 hours @ 70°C.				
Modulus 300%	470	900	1090	620
Tensile	2470	2660	2840	2000
Elongation (%)	850	705	690	895
Hardness	75–62	81–69	87–75	87–77
ASTM No. 3 Immersion Physicals—96 hours @ 70°C.				
Modulus 300%	420	790	1040	400
Tensile	2500	2640	3260	2130
Elongation (%)	865	715	695	965
Hardness	64–50	69–56	80–67	78–67
Reconditioned (24 hrs. at 158°F.)	70–60	74–68	88–81	90–83
Aromatic Fuel Immersion Physicals (70% Isooctane—30% Toluene) After 72 Hours at Room Temperature				
Modulus 300%	250	490	620	230
Tensile	1850	2110	1860	1400
Elongation (%)	895	715	595	915
Hardness	40–32	46–40	28–26	18–16
After Aromatic Fuel Immersion				
Weight Change (%)	+22.4	+20.8	+17.73	+5.57
Volume Change (%)	+24.3	+26.3	+27.31	+10.70
After Reconditioning at 158°F. for 4 Hours				
Weight Change (%)	—	—	+2.39	−12.08
Volume Change (%)	—	—	+3.86	−15.71
After Reconditioning at 158°F. for 24 Hours				
Weight Change (%)	+0.17	+0.22	−0.25	−17.8
Volume Change (%)	+1.10	+1.50	−1.06	−19.8
Hardness	75–63	76–65	87–79	83–78

the physical qualities of SMR and control compositions is indicated. SMR has better retention of tensile and elongation than the DOP composition and in these qualities equals the control composition without plasticizer. The DOP composition reflects the loss of plasticizer by extraction as shown in Figure 8. Note the high hardness of the reconditioned ASTM 3 oil immersion test. Even the hardness increase of the unplasticized composition on reconditioning is absent in the silicone modified compositions.

A report by Naugatuck Chemical covering the comparison of Paracril C compositions, reinforced with 58.5 parts of Hi-Sil 202, and containing 5.85 parts of LM3 and 23.4 parts of Paraplex G-25, respectively, states: "Tensile and elongation retained are considerably better for the LM3 compound. The LM3 stock has a greater negative hardness and greater volume swell than the Paraplex G-25 compound."

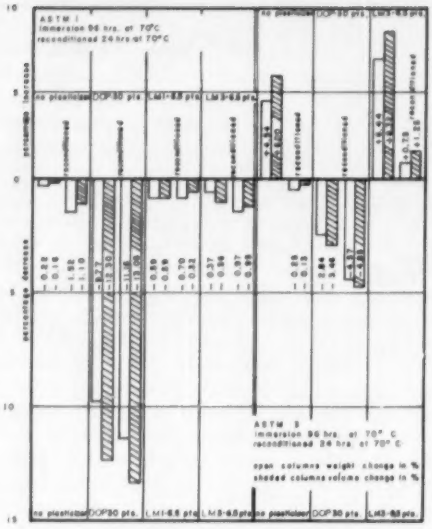


FIG. 8—Oil immersion data for ASTM No. 1 and 3 oils.

Aromatic Fuel Immersion

Physical qualities and weight and volume changes after immersion in 70% iso-octane and 30% toluene, Mil-R-3136, are also given in Table XIX. Tensile retention is much better for the silicone modified rubber than for either the control without plasticizer or the DOP composition. The hardness change affords the most striking difference in that the silicone modified rubbers show much less hardness decrease after 72 hours' immersion and very little change from the unaged hardness after reconditioning.

For uses where low compression set or recovery was not critical, silicone modified nitrile rubbers which can be compounded, calendered, extruded and molded, with twice this volume loading of silica, would be indicated for resistance to aromatic fuels.

Resistance to Acids

Amorphous silicas when coated with silicone oils by the water slurry process, or when formed by the reaction of metal salts with sodium silicate in dilute solutions in which are present mechanically emulsified silicone oils, are not wetted with hydrochloric acid. These

TABLE XX—CRESCENT TEAR RESISTANCE OF NITRILE RUBBER-HI-SIL 202 COMPOSITIONS AT 40 VOLUME LOADING

(In Pounds per Inch)

Plasticizer	Amount (Parts)	No. of Tests Averaged	Condition of Aging: Unaged	Oven Aged 96 hrs. at 250°F.	Oven Aged 72 hrs. at 300°F.
LM3	6.5	25	452	—	—
LM3	6.5	7	—	440	339
None	—	4	419	338	76
DOP	30	7	341	107	89
Paraplex G-25	30	1	216	—	—
Trioctyl Phosphate	30	1	237	—	—
Flexol R2H	30	1	225	—	—

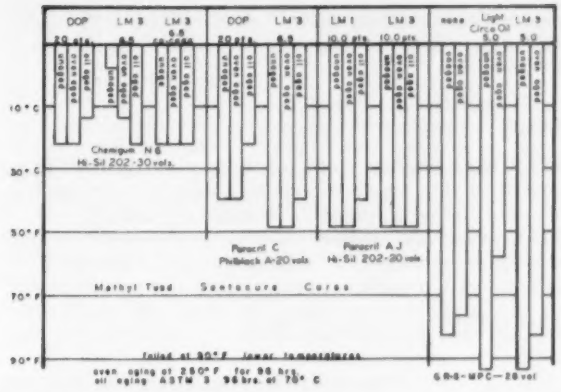


FIG. 9—Low temperature brittle point passing temperatures.

amorphous silicone-coated particles never sink in the HCl solution. Nitrile rubber compositions reinforced with these silicone-coated fillers have been used successfully for pump and impeller linings and successfully resist acids. LM3-coated Hi-Sil used as a filler in Kel-F Elastomer gave compositions resistant to red fuming nitric acid.

Tear Resistance

A uniform dispersion of silicone oil on filler particles, and particularly the oriented bonded molecular coating of the water slurry dispersion process, gives a reinforcing material that appreciably improves tear resistance with both black and non-black fillers and with all the rubbers tested. The difference in favor of silicone modification is greater following heat aging and oil immersion. Table XX gives average values for a number of tests of unaged and oven aged nitrile rubber-Hi-Sil compositions.

Low Temperature Qualities

Low temperature qualities, as measured by brittle point test procedure, are lacking in the higher acrylonitrile rubbers when reinforced with 40 volumes of silica,

TABLE XXI—COMPRESSION SET (METHOD B) OF PARACRIL C-HI-SIL 202 COMPOSITIONS AT 40 VOLUME LOADINGS WITH METHYL TUAD AND SANTOCURE CURES

(Tested for 22 Hours @ 70°C.)

Compositions	21A	21B	21C	21D
Plasticizers	None	DOP 30	LM3 6.5	LM3 13.0
Unaged	55%	66%	32%	35%
Oven Aged 96 hrs./250°F.	37%	47%	25%	28%
ASTM 3 Immersion 96 hrs./70°C. Reconditioned 24 hrs./70°C.	48%	62%	26%	30%

the type of composition most widely tested in this study. Silicone modification does not improve these high silica-loaded nitrile rubbers. In these compositions the benefits of addition of low temperature plasticizers, such as DOP and TOF, are not retained after heat aging or oil immersion. Recent work on the dicumylperoxide cure of these rubbers gives promise of much improved low temperature qualities.

Silicone modification of Chemigum N6 with 30 volumes of Hi-Sil 202 (Tuad cured), Paracril C with 20 volumes of Philblack A, Paracril AJ with 20 volumes of Hi-Sil 202, and GR-S with 28 volumes of channel black do show some benefits in low temperature qualities, especially after heat and oil aging. These compositions are reported in Figure 9 as to the low temperature brittleness "passing" temperature.

Electrical Insulating Qualities

Silicone modification increases electrical insulating qualities, both in unaged rubbers and following water immersion. The water resistant qualities of SMR and the rejection of salts, as shown in Table XVIII, indicate their particular adaptability where negative electrical conductivity is an essential.

Nitrile rubbers rank low in order of electrical resistivity, but the Paracril C 40 volume silicone-coated Hi-Sil compositions for which resistivity is shown in Figures 10 and 11 have, after water immersion, quite creditable

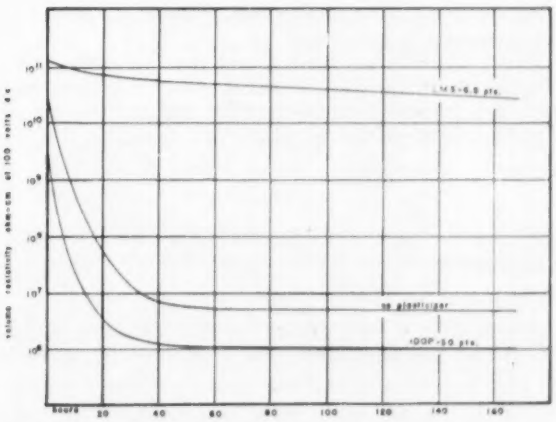


FIG. 10—Electrical resistivity of Paracril C-Hi-Sil compositions. (Distilled water immersion at room temperature).

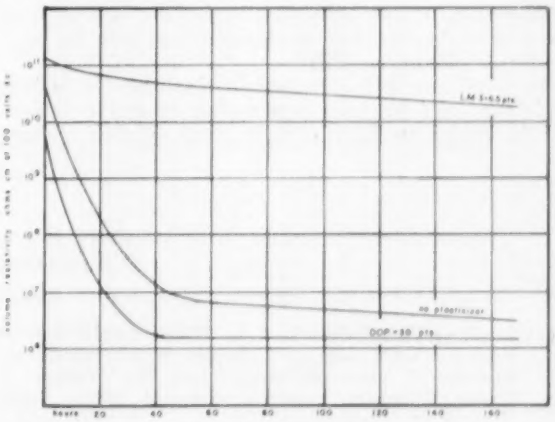


FIG. 11—Electrical resistivity of Paracril C-Hi-Sil compositions. (Distilled water immersion at 70°C. temperature).

insulating qualities. The non-plasticized and DOP compositions are seriously affected by water immersion. Where heat, age, oil immersion, tear and abrasion resistance are requisites, these rubbers should prove quite acceptable, despite the polar nature of the elastomer. Very high silica loadings, as high as 80 volumes, 157 parts by weight, which even with high acrylonitrile elastomers give good workable compositions, should increase electrical resistivity as well as oil resistant qualities.

Recovery and Compression Set

The "silicone bridge" outlined in the introduction produces a recovery or "nerve" in the compounded uncured silicone modified rubber which is illustrated in Table II (Williams Recovery Numbers) and observed in the recovery or dimensional increase (without loss of density) in the "tubing" of SMR.

In all tests, and with various rubbers, recovery is better and compression set is lower than for compositions plasticized with DOP, Paraplex G-25, Circo Oil, trioctyl phosphate, or with other plasticizers, particularly those of the lubricating type. Also, these rubberlike qualities are usually better than for compositions without plasticizers.

Paracril C, a high acrylonitrile content elastomer, is a high compression set rubber when Tuad cured with 40 volumes of Hi-Sil 202. A comparison of set values for Paracril C compositions is shown in Tables III, IV and VIII. Compression Set Method B, 22 hours at 70° C., is lower for the silicone modified rubber as compared with the composition with 15 parts DOP or without plasticizer. The advantage persists after circulating oven aging at 250° F. for 96 hours and after immersion in ASTM No. 3 Oil (a low extracting oil) and reconditioning the samples for 24 hours at 70° C.

The fact that all the physical qualities of these SMR compositions are improved by heat aging, with moderate increase in stiffness and hardness, offers the opportunity to improve recovery and set in SMR without sacrifice of other qualities.

Abrasion Resistance

A report in 1947 *(6)* indicated that the addition of silicone oils to normally plasticized GR-S-black compositions increased abrasion resistance by as much as 100 percent. In the work here reported, silicone modification, and particularly reinforcing with water slurry LM3 dispersions on Hi-Sil and on blacks, showed substantial improvement of abrasion resistance for SMR as compared with the use of other plasticizers or with the compositions without plasticizer.

State of cure was important in obtaining the highest resistance, and here the post curing of nitrile rubber-Hi-Sil silicone modified rubbers increased their proportionate advantage over control compositions with no degrading of other qualities, such as tensile, elongation and tear.

Summary

The very limited scope of test work briefly summarized in this paper has covered several years and is an evaluation of a considerable mass of data.

The theory of silicone modification, the nature and stability of an oriented "silicone bridge" between filler particles and organic materials, and the qualities that can be expected as products of these inter-molecular and inter-surface phenomena are considered in this study.

Not only in rubbers, but in plastics, in bonding cements, in water repellant uses apart from rubbers and/or plastics, there is a demand for, and an opportunity to exploit, such improvements in qualities, and even marginal gains, though obtained at a considerable increase in cost, would find a market.

It is hoped that in the very broad field of potential usage of these unique silicone-filler complexes, the rubber and plastics industries will find much of interest.

ACKNOWLEDGMENTS

The Silicone Department of the Linde Air Products Co., now operating as the Silicone Division of the Union Carbide and Carbon Corp., conducted extensive research work both at the V. L. Smithers Laboratory in Akron, Ohio, and at their own laboratories in Tonawanda, N. Y. The company's facilities for electron micrograph work, chemical analysis and rubber testing were fully utilized. The development of silicone-coated fillers by the water slurry process and of filler products giving some new and interesting silicone-coated amorphous silicas were greatly advanced by this extensive work, covering some three years.

The B. F. Goodrich Chemical Co., the Chemical Division of the Goodyear Tire & Rubber Co., the Naugatuck Chemical Division of the U. S. Rubber Co., and the Columbia-Southern Chemical Co. all contributed substantially in laboratory work and in valuable suggestions to the study of silicone modified rubber.

All of the SMR products mentioned in this paper—rubber compositions, silicone-coated fillers, co-coagulated rubbers and fillers—are currently being produced by the Stoner Rubber Co. Testing and evaluation work is constant, with the object of fully establishing reproducible qualities. Production was started in 1955, is continuing, and expansion is anticipated.

To all of these companies, and the individuals who comprise them, the author makes grateful acknowledgment, for the work, the cooperation and the permission to make full use of the test data.

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New Air-Drying Protective Finish for Steel Battery Trays

A NEW air-drying, protective finish for steel battery trays which eliminates the baking process in manufacture has been developed by the Exide Industrial Division, Electric Storage Battery Company, Philadelphia, Penna. The quick-drying finish—called Flexide—not only has excellent adhesion and electrical insulating properties but is hightly resistant to abrasion and acid. It can be used by manufacturers to speed tray production and by truck users to make on-the-spot repairs without time lost in baking.

Flexide is compounded of a plastic base material with fillers to produce the desired color and physical and chemical characteristics. Development of the material is a result of the battery manufacturer's continuing program of investigation in metal finishes. Impervious to battery acid, Flexide provides a continuous, impermeable coating with no pinholes or edge-thinning. It permits a thicker coating and provides more protection per application than was possible with baked-on finishes. Accordingly, Exide has standardized on a thicker coating than formerly used on electric industrial truck battery trays. The new finish is superior to an equal thickness of baked finishes in abrasion resistance and electrical insulation.

Proved in the Exide engineering laboratories were Flexide's outstanding abilities to cover and spread smoothly and easily over a tray surface; to adhere to steel in impact and abrasion tests; to withstand battery acid and limit tray corrosion, and to provide electrical insulation. Flexide has been field tested for two years in typically rugged electric industrial truck service. Only after these exhaustive tests demonstrated Flexide's superiority as a tray finish was it adopted for Exide products.

Easily applied with brush or spray gun, Flexide makes it possible for the battery user to quickly and economically repair scratched or damaged surfaces, and thus, to provide continuous tray protection. Exide engineers point out that Flexide minimizes the need for such repairs by eliminating the danger of chipping. Much of the need for repairing accidentally scratched surfaces can be eliminated by using reasonable care in installing or removing trays from trucks.

Coming Next Month....

"Effects of Mixing Time on Properties Imparted to Rubber by Reinforcing Carbon Blacks"—by Dr. Isaac Drogin, United Carbon Co., Inc., Charleston, W. Va.

Taking note of the necessity for changes in mixing cycles due to increase in rubber output and rate of processing without parallel increase in available mixing equipment, the author presents useful data on the effects of mixing time on properties imparted by reinforcing carbon blacks to natural rubber, Enjay Butyl, and butadiene-styrene rubber, both 41°F. type and that extended with 37½ parts oil PHR, as well as a half-and-half blend of the two. The data are based on extensive experiments with 12 masterbatches. The role of each of five types of carbon blacks is discussed, as are previous technical reports on property changes under variable mixing conditions.

"Electrical Stabilization of Conducting Neoprene Films"—by A. G. Sands and M. V. McDowell, Chemistry Division, Naval Research Laboratory, Washington, D. C.

Effects of moisture on electrical properties of conducting latex-cast films are discussed and a means of minimizing these effects by a simple boiling water treatment, which leaches the water-sensitive components from the film, is presented. Also described is a method of preparing cheap plaster-of-paris molds and formulating and casting conducting latex films.

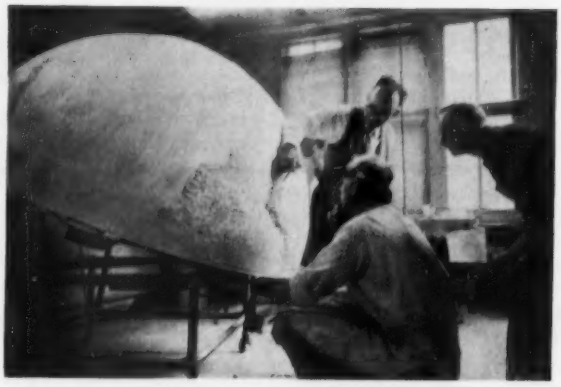
Plus several short practical articles.

Molded Vinyl Relief Globes Lend Themselves to Mass Production

THE development of a 12-inch relief globe of the world, which lends itself to mass production methods, has been achieved by Geo-Physical Maps, Inc., New York, N. Y. Although globes are known to have existed before the time of Christ, a major problem has always been the production of relief globes in quantity. The new "Geo-Physical Globes" are completely up-to-date and accurate. A group of the world's leading geologists, cartographers, and other geographical authorities, combined to plot the new map. Molded of rigid vinyl to show the natural contours of the earth, it is made in two parts which snap together at the equator.

Geo-Physical Maps is also producing a six-foot version of the globe. This model, designed primarily for libraries, museums, schools, etc., is cast as a sturdy shell with an inflatable bladder which will enable it to be transported while folded up. Weighing 85 pounds, it can be installed anywhere. The six-foot model is made of "Texture-Flex," a rubberlike material which finds use in theatrical displays. The entire globe is cast in blue Texture-Flex, but the land forms are hand painted in life-like air view colors. No cities, boundaries, or grids will appear unless ordered. Every detail of the globe is aimed at giving a vivid, man-in-space impression of the world, while approximating the feeling of how the world ought to look.

The six-foot globe has an unusual free revolving stand. This stand, with bearings in the base, permits the globe to be revolved in any manner on any axis, so that it can be viewed at whatever angle desired. The globe is washable and deflatable. The first of the new globes has already been sold to a major television network where it will be installed to give a new authority to news and special events programs.



Designers are shown here detailing a mold for a future 6-foot Geo-Physical Map.

Automatic Vulcanizer for Retreading Eliminates Air Bags

CURING tires without the use of air bags has long been the dream of the tire building and retreading industry. Now, with the introduction of the R-36 automatic vulcanizer by the Goodride Tire Company of Akron, Ohio, this problem is said to not only have been solved but has brought automation to the tire retreading industry.

The new Goodride machine is operated by pushbutton controls. In 21½ minutes total time, which includes buffing and putting on camelback and sidewalls, it produces a tire that, to all appearances outwardly and in cross-section, is completely new, bead to bead. The tire is, moreover, made tubeless, and can be made with either white or black sidewalls.

The Goodride method can be used on passenger tires of all sizes. Vital point in the 21½ minute complete tire process is the 15 minute automatic curing cycle. Live steam is channeled directly to the inside of the casing, and pressure is regulated automatically throughout the curing cycle. Stretching of cords and rubber resets each cord in its proper rubber bed. The elimination of the air bag, up to now essential in all types of tire-building and retreading operations, cuts down labor requirements as well as time. Present conventional retread operations, requiring much manual labor, now take about an hour and a half per tire, and cannot possibly make a tubeless tire from a conventional tire, or put on a white sidewall.

Goodride tire plants, which will be leased to operators, include, in addition to the automatic bagless vulcanizing machines (R-36), two other automatic machines designed to complement it. One, an automatic buffer, removes old treads and buffs sidewalls in one and one-half minutes. The second machine is a tire builder which applies camelback and sidewalls in 3½ minutes. Eighteen months of extensive road-testing of Goodride tires has proved that they are as durable as new tires are when in steady operation.

Bead-to-bead retreading for truck tires, similar to that now possible for passenger tires, is envisioned for the near future. The company is putting finishing touches on an automatic truck tire curing machine which, like the R-36, will produce tires with bead-to-bead retread, without the use of bags, rims, or locking bolts.

Rubber as well as other materials can be cut into lengths from less than one inch to several hundred feet with the **Model 30A Length Controller** of Graham Transmissions, Inc., Menomonee Falls, Wis. The unit, with a reported accuracy of 4/100th of 1%, is connected to a conveyor head shaft, draw roll shaft, capstan or other shaft controlling the rate of feed of the material.

Developed especially for use in flash point tests, the **Slo-Speed stirrer** offered by the Precision Scientific Co., 3737 West Cortland St., Chicago 47, Ill., can be adapted to any laboratory procedure requiring stirring at a slow, constant speed. Geared for a speed of 78 rpm, when used on direct drive, the stirrer also provides for a variety of speeds through the use of several pulleys.

The Reaction of Molecular Oxygen with Rubber

By E. M. BEVILACQUA
General Laboratories, United States Rubber Co., Passaic, N. J.

IT IS nearly a century since Hofmann and Spiller made the first recorded experimental observations linking oxygen with substantial changes in polyisoprenoid hydrocarbons *(1)*. In the first sixty-odd years following this work technological progress was slow, but certain characteristic features of the oxidation reaction were observed. It was firmly established that oxygen played an important role in the deterioration of rubber and rubber products with the passage of time, and the accelerating effects of exposure to light or to elevated temperatures were realized. Within a short additional period a very nearly complete solution to the problems of oxygen aging was obtained with the discovery of efficient vulcanization methods and of effective antioxidants. These discoveries made possible the transition of rubber from a relatively expensive, short-lived material of commerce to its present position of a high-volume, low-cost, essential ingredient of our everyday life. Since that period technological progress has consisted in steady refinements of these important discoveries.

During these years many observations necessary for understanding the chemistry of the oxidation process were accumulated, but it was necessary to wait for two fundamental developments in order to obtain a complete explanation of the reactions occurring during the reaction of rubber with oxygen. These were, first, a clear realization of the high molecular character of the rubber hydrocarbon and the effect of this on its macroscopic properties, and, second, the work on oxidation of low molecular weight olefins which forms the basis for inferring the nature of steps in the oxidation of rubber inaccessible because of experimental difficulties. Since both of these developments have been made it is quite probable that we shall know in complete detail the reaction sequence in rubber oxidation before the centennial of Hofmann's paper is reached.

In one sense this process is already completely understood. Considering a piece of vulcanized rubber as an array of strings tied together at random by a few knots, its properties can be quantitatively described with an error of 100 per cent or less, simply in terms of the average length of the strings and the number of knots. In this view, oxygen is pictured as a somewhat unique set of scissors which may cut the strings or add knots to the assembly, depending on the properties of the strings. The discussion in this paper is concerned with what may be called the organic chemistry of the cutting process, that is, the actual series of steps leading to what is observed macroscopically as the effect of scission. It will be restricted to natural rubber because it is the rubber which has been studied the most and is the only one for which we have some idea of the molecular processes occurring.

Crosslinks and Interlink Chains

In the aging of rubber products in service, two loci for attack by oxygen may be distinguished—crosslinks and the interlink chains. The sites of crosslinkage are chemically quite distinct from the rest of the mass, whose properties may be expected to be identical with those of the uncured hydrocarbon. The relative importance of these two is still not clear.

Considering first the interaction of oxygen with the hydrocarbon, without the complication of crosslinks, we may start from the familiar phenomenon illustrated in Figure 1, which is redrawn from data obtained by McGavack and Lundstedt *(2)*. The time required for a sample of USF rubber to reach ML4-65 when milled under standard conditions on an open mill is plotted against stock temperature. The dashed line illustrates the behavior of rubber on oven aging at temperatures below the peak of the curve. Over the entire temperature range covered by this curve oxygen is essential to the breakdown process *(3)*.

On inspection of the curve it seems fairly obvious that the same reactions can hardly be involved at low temperatures as operate at high. An explanation for the negative temperature coefficient of rate of breakdown indicated by the left hand portion of this curve was advanced by Kauzmann and Eyring *(4)* and thoroughly established experimentally by Watson and co-workers *(5)*. At low temperatures, where the vicosity of rubber is high, shearing stresses are high enough to cause rupture of the hydrocarbon. The function of oxygen is to react rapidly with the free radicals formed by rupture, preventing their recombination. Many other radical acceptors will function in the same way in low temperature milling, although none is as efficient as oxygen.

In contrast, the behavior indicated by the right hand portion of the curve of Figure 1 is unique to oxygen

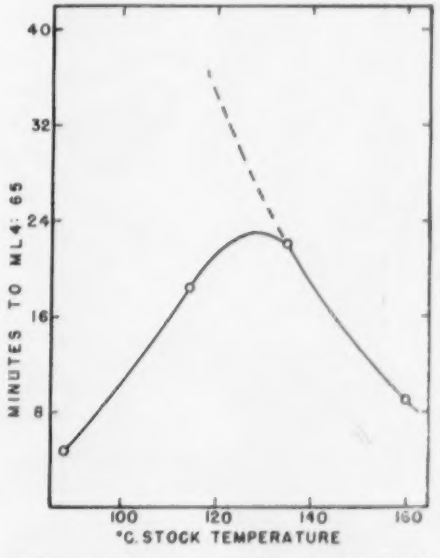


FIG. 1—Rate of breakdown of USF rubber on an open mill.

Note: This paper was presented before the Rubber Chemistry Division, Chemical Institute of Canada, Montreal, Canada, May 30, 1956.

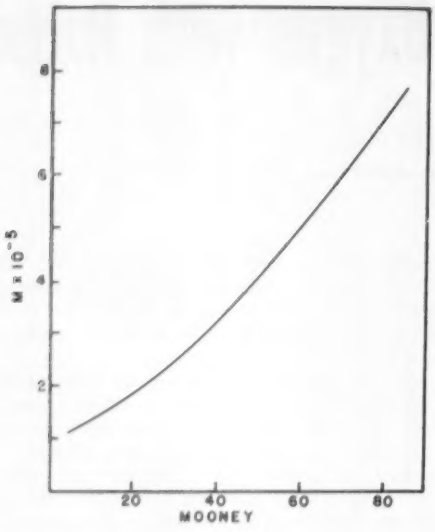


FIG. 2—Relation between molecular weight and Mooney viscosity (natural rubber).

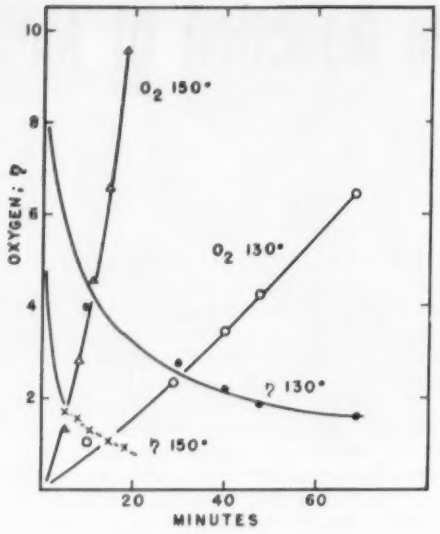


FIG. 3—Oxygen absorption and rubber breakdown in an atmosphere of oxygen. (Oxygen in moles per 10^5 grams, intrinsic viscosity in dl/g; oven temperatures as indicated).

and exhibits the characteristic features of olefin oxidation in general. It is this region which is pertinent to the problem of aging as well as to breakdown of raw polymer.

It is of some interest to consider for a moment the magnitude of the molecular effects which must be detected in investigating oxidation. Figure 2 shows approximately the molecular weight of natural rubber as a function of its Mooney viscosity. This curve is calculated from a large number of measurements relating solution viscosity and Mooney viscosity obtained by Lundstedt and myself *(6)*, using the relations given by Carter, Scott, and Magat *(8)*, between solution viscosity and molecular weight. The Mooney-solution viscosity data are in good agreement with one of the two published curves *(9)* relating these two. In the range of Mooney viscosities encountered in practice, the molecular weight varies from the order of one million down to about one hundred thousand. The concentration of free ends produced on breakdown is thus roughly 10^{-5} moles

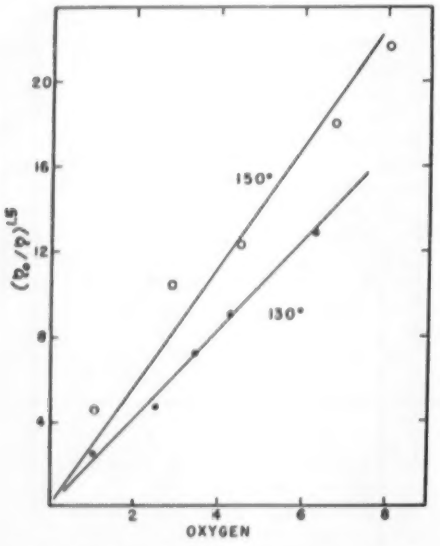


FIG. 4—Correlation between oxygen absorbed and ratio of initial and final viscosities. (Oxygen in moles per 10 grams).

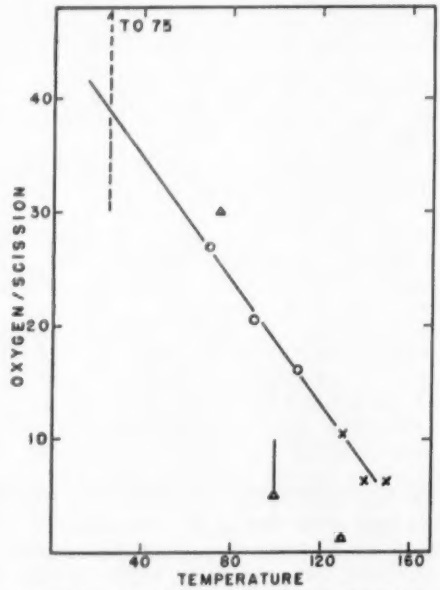


FIG. 5—Scission efficiency as a function of temperature. (Moles oxygen/mole scissions).

Dotted line—Farmer and Sundralingham (12); Vertical bar—Horikx (14); Triangle—Tobolsky et al (11); O—latex (15); X—USF (10).

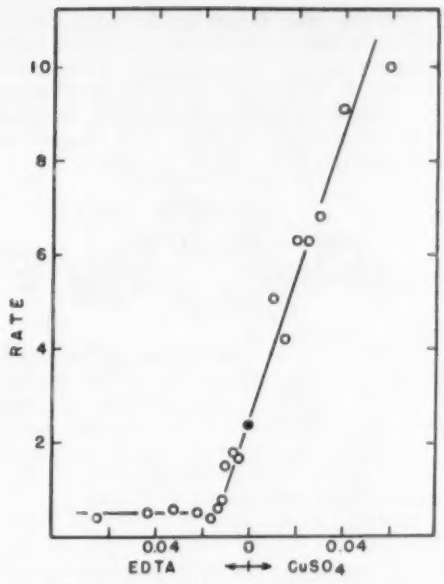


FIG. 6—Constant rate of oxygen absorption by latex as a function of added inhibitor (EDTA, ethylenediaminetetraacetic acid) or of accelerator ($CuSO_4 \cdot 5H_2O$).

Abscissa—weight per cent copper equivalent to added material. Ordinate—moles/10^5 g./hr.

per gram. In this paper quantities of oxygen absorbed and products formed are reported in units of this size, i.e., moles per hundred thousand grams.

The most obvious effect of the reaction of oxygen with rubber is the rapid fall in polymer viscosity produced by absorption of a small weight per cent of oxygen. This is shown in Figure 3, which gives details for two experiments previously reported in part *(10)*. Oxygen consumed and intrinsic viscosity in benzene are plotted as a function of time at two temperatures in an atmosphere of oxygen. The results illustrate both the rapid fall in rubber viscosity and the characteristic "autoacceleration" of oxygen absorption. The correlation between oxygen absorbed and molecular breakdown is made more obvious in Figure 4. The quantity $(\eta_0/\eta)^{1.5}$ is very nearly proportional to the number of scissions of the hydrocarbon chain, so that it can be concluded that a constant fraction of oxygen consumed is used in scission.

This fraction is a function of temperature. The temperatures for the experiments illustrated in Figures 3 and 4 were chosen on the basis of observations by Tobolsky, Metz and Mesrobian *(11)* which indicated that very efficient utilization of oxygen for scission occurs at high rates of oxidation (i.e., high temperatures), in contrast to low efficiencies observed by Farmer and Sundralingham *(12)* in work at room temperature. Although there is no quantitative agreement between estimates of scission efficiencies obtained in various ways, they all agree with the conclusion of Tobolsky and co-workers that scission is more efficient at high temperature, as shown in Figure 5.

Figure 5 contains all the reported values of the relation between estimated oxygen consumption per scission and temperature, given with any supporting data, except those of Baxter, Potts, and Vodden *(13)* which are in general agreement with those of Tobolsky et al

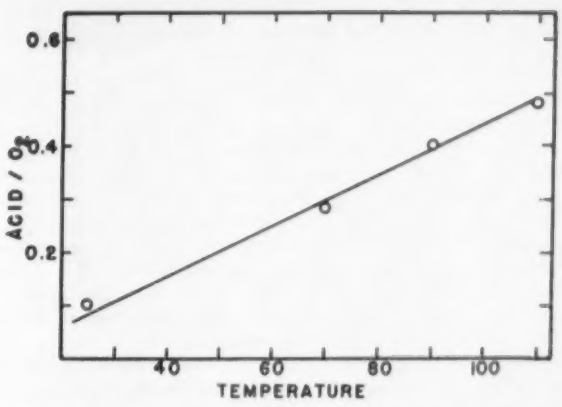


FIG. 7—"Titrable" acid produced on oxidizing latex. (Acid/O_2 in equivalents per mole).

(11), which are plotted. The wide range indicated by the dashed line representing Farmer's results for photo-oxidation experiments *(12)* is not representative of experimental variation, but results from an apparent increase in oxygen required per scission as oxidation progresses. This was not observed in my experiments. The triangles are taken from Tobolsky *(11)*, the solid line from Horikx *(14)*; crosses represent experiments with dry raw rubber *(10)* and circles experiments with latex *(15)*.

Having found a direct correlation between oxygen consumed and molecular scission, the next step is to discover if any other products can be quantitatively correlated with oxygen and, by inference, with scission. For this, oxidation of latex offers several experimental advantages *(16)*. Among these is the ready and reproducible control of the (constant) rate of oxygen consumption (Figure 6). (It should be noted that the

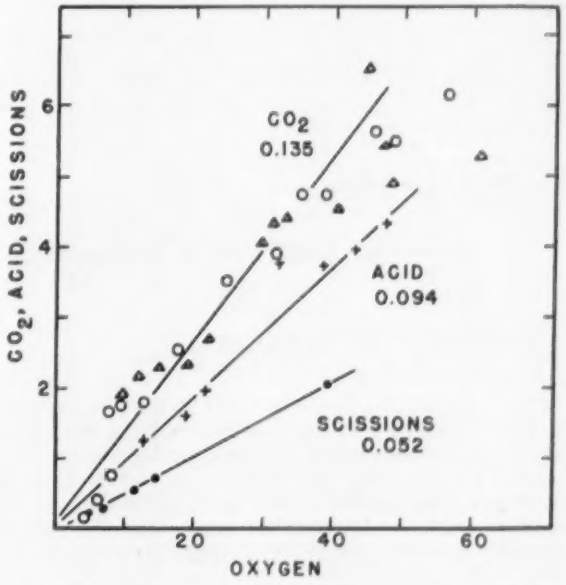


FIG. 8—Products of the scission reaction at 90°. (Units: moles/10^6 g.).

Triangle—previously reported (16); O—new data. (Numbers on curves are slopes in moles per mole).

amount of EDTA required to reach the limiting rate is 50 to 100 times the amount equivalent to copper actually present in commercial latex).

The most important property of latex for our purposes is its reserve alkalinity, which traps acids effectively in the aqueous phase. Figure 7 shows that the yield of "total acid" determined by direct titration of the latex increases with temperature just as scission efficiency does (Figure 5). The only acids found to be formed on oxidation have been carbon dioxide and formic and acetic acids *(16)*. In Figure 8 the yields of these and of scissions of the hydrocarbon are plotted as a function of oxygen consumed. The curve labeled "acid" is the sum of the amounts of acetic and formic acids, which are produced in equivalent amounts *(16)*.

The data of Figure 8 were obtained from experiments at 90°. The ratios between CO_2, acids and scissions are independent of temperature *(15)*. Each of the quantities is a linear function of oxygen consumed, except that carbon dioxide appears to fall off at high extents of oxidation. This may result from exhausting the alkaline reserve. No loss of CO_2 has been observed on heating in nitrogen latex containing added sodium carbonate. Each curve in the figure is labeled with its slope. From these we can calculate the ratios:

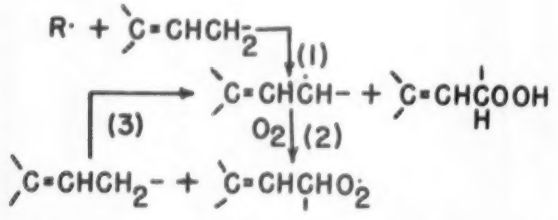
$$\frac{CO_2/O_2}{\text{SCISSIONS}/O_2} \approx 2.6$$

$$\frac{RCOOH/O_2}{\text{SCISSIONS}/O_2} \approx 1.8$$

$$CO_2/RCOOH = 1.45$$

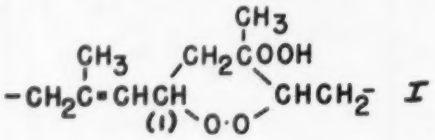
A preliminary carbon balance calculated from these figures shows that five or six carbon atoms appear as low molecular weight acids for each cut in the hydrocarbon chain, or approximately one isoprene repeating unit is destroyed at each scission.

To connect this rough stoichiometry with the details of the reactions which yield the observed products, it is profitable to review briefly what is known about olefin oxidation. The excellent kinetic work done at the BRPRA *(17)* has established the reaction sequence outlined schematically below to describe the steps in the oxidation of simple olefins:



In this sequence reaction is initiated by the (unspecified) radical R• which removes a hydrogen from the alpha-methylene group (step 1). The resulting radical adds oxygen rapidly (step 2). The peroxy radical removes hydrogen from another molecule of olefin to give the hydroperoxide product and regenerate the allyl radical. Under favorable conditions hydroperoxide yields are very high.

Complications in this scheme are introduced by changes in the olefin structure. In the olefins of interest here the presence of a neighboring double bond alters the course of the reaction. Bolland and Hughes *(18)* have shown that, in squalene, approximately four atoms of oxygen disappear for each hydroperoxide (and active hydrogen) which appears and that on reduction of the peroxide a triol is formed in which two of the hydroxyl groups are adjacent. Several structures can be written, consistent with these observations. Bolland and Hughes suggest that the form present in largest amount is:

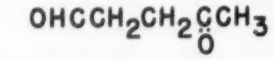


I

This is produced by the intervention of two additional steps in the sequence shown for simple olefins. The peroxy radical resulting from addition of oxygen at the carbon atom labeled (1) in the formula adds at one end of the nearby double bond to give a six-membered cyclic radical which then goes through the normal steps of oxygen addition and hydrogen capture.

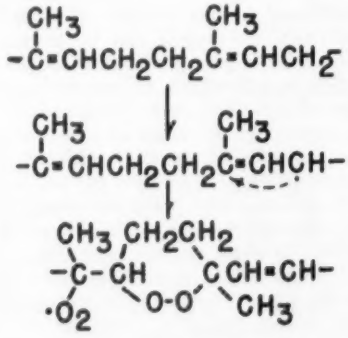
Since squalene is structurally similar to rubber it is to be expected that similar forms exist in the oxidation products from rubber. The hydroperoxide as shown involves five carbon atoms and has a side chain methyl group which might appear in acetic acid, and thus might give rise to the observed products.

There is, however, one additional observation which cannot be explained on the basis of structure (I). It has been frequently observed *(2, 7)* that a volatile product is formed during the aging of rubber, which reacts with ammonia to form a product giving the color reactions of pyrroles. According to Whitby *(19)* it reacts with phenylhydrazine to give a dihydropyridazine identical with that obtained from levulinaldehyde:

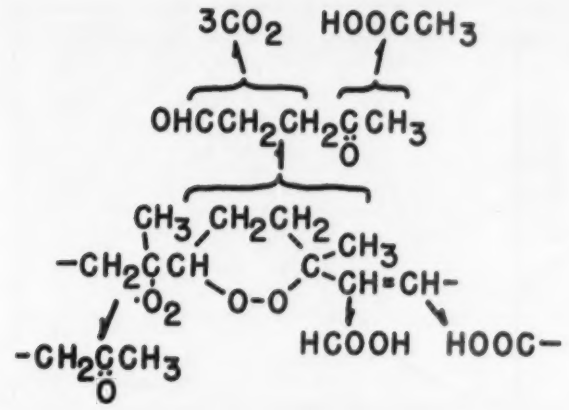


To form this from an intermediate involving the cyclic structure (1) shown above, carbon atom (1) would have to be reduced, an unlikely sequence of events.

However, this observation can be fitted into a consistent reaction scheme, derived from a hydroperoxide having the properties observed by Bolland and Hughes, if it is assumed that double bond shifts occur in that fraction of the intermediate oxidation product which is involved in scission. One such possibility is illustrated by the reactions:



Without making any assumptions as to whether this peroxy radical or the hydroperoxide derived from it is the intermediate which undergoes scission in subsequent steps *(20)*, it can be seen that it contains all the structural elements required to account for known features of the reaction, shown in the following scheme:



In summary these are:

1. Probable end groups on the oxidized hydrocarbon $CH_3C(O)$-and-CO_2H[Naylor *(21)*].
2. Levulinaldehyde production from dry rubber [Gorter *(1)* and Whitby *(19)*], in yields possibly approaching scission yields *(7)*.
3. Formaldehyde and formic acid production [Kemp et al *(22)* and Dawson and Porritt *(23)*], in stoichiometric equivalence to scissions *(16)*.
4. Acetic acid production [stoichiometric *(16)*].
5. Carbon dioxide/volatile acid ratio 1.5 (this paper).
6. Production of three moles of carbon dioxide and one of volatile acid per mole of levulinic acid oxidized in dilute ammonia solution *(7)*.
7. Properties of the primary oxidation product of low molecular weight polyisoprenes [Bolland and Hughes *(18)*].

Properties of Crosslinked Networks

With this picture of the mechanism of the reactions leading to breakdown of the hydrocarbon itself set forth, we may turn to the alternative problem, mentioned in the introductory paragraphs, of what, if anything, happens at crosslinks when oxidation occurs.

New tools for investigating the properties of crosslinked networks are now in use in several laboratories in an aggressive attack on this problem. These tools have arisen out of the development of the theory of the macroscopic properties of a network as a function of the primary molecular size and of the crosslink density. The first of these to be applied was the phenomenon of stress relaxation.

It was observed independently by Mooney, Wolstenholme, and Villars *(24)* and by Tobolsky, Prettyman and Dillon *(25)* that at low temperatures the stress in a piece of vulcanized rubber stretched to low elongations decreased relatively rapidly in an atmosphere containing oxygen, compared with the rate of decrease in its absence. Since then stress relaxation (or the closely related creep under constant load) has been extensively explored for its potential as an accelerated aging test, and is now in fairly general use for this purpose. It has two advantages over older tests: It yields results very rapidly and is easily adapted to testing large numbers of samples *(26)* and it measures a property which is probably closely related to the demands of some service conditions.

More recently, relaxation at constant strain has begun to be explored for its interesting possibilities for unraveling the fundamental molecular processes occurring during aging. The present state of this work emphasizes

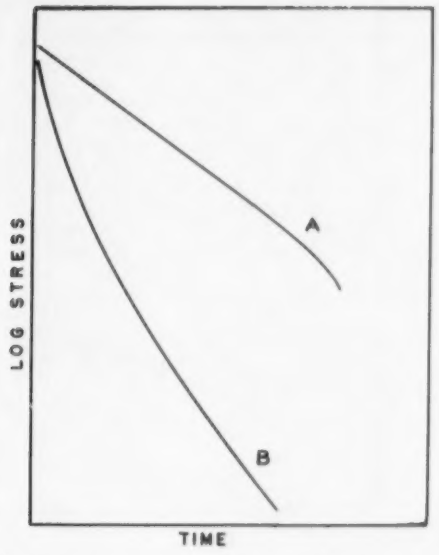


FIG. 9—Stress as a function of time, calculated by Bueche (28).

Curve A—random scission; Curve B—scission restricted to crosslinks. Units arbitrary.

the importance of the distinction between oxidation of the hydrocarbon and of the crosslink.

The theory of rubber elasticity predicts a relation between stress and elongation of the form *(27)*:

$$\tau = RT\nu\, f(\alpha),$$

where τ = force/unit undisturbed cross-sectional area,
ν = concentration of effective points of restraint in the vulcanized network, and
α = ratio of stretched to unstretched length.

If T and α are held constant, any change in τ will be a measure of changes in ν. Bueche *(28)* has shown that under certain (assumed) conditions it will be possible to distinguish between random breaking of hydrocarbon chains and restricted attack at the crosslinks if either is the predominant way in which relaxation occurs. Figure 9 is taken from his paper. If scission occurs by a random breaking of hydrocarbon chains, stress decay with time should be of the form of curve B. If only crosslinks are severed, curve A represents the expected behavior. In practice, most observers have reported an approximately linear decay of log stress with time (for natural rubber) *(11, 13, 26, 29)*. In addition to the evidence from rates of relaxation, Berry and Watson *(29)* list four other factors supporting the conclusion that crosslinks are broken in low temperature oxidation:

1. Different hydrocarbons vulcanized in the same way relax at comparable rates.
2. Rates of relaxation of peroxide and sulfur-cured natural rubber are different.
3. Stress relaxation is insensitive to oxygen pressure down to very low pressures.
4. Retarders for hydrocarbon oxidation have an unexpectedly small effect on relaxation rates.

Another piece of evidence exists in the published information relating oxygen absorption and stress relaxation *(11, 13)*. In Figure 10, Tobolsky's results for oxidation of one natural rubber sample *(11)*, estimated from his Figure 11, are replotted for two assumptions as to the nature of the scission reaction. Curve 1 is calculated using the expression given by Berry and Watson

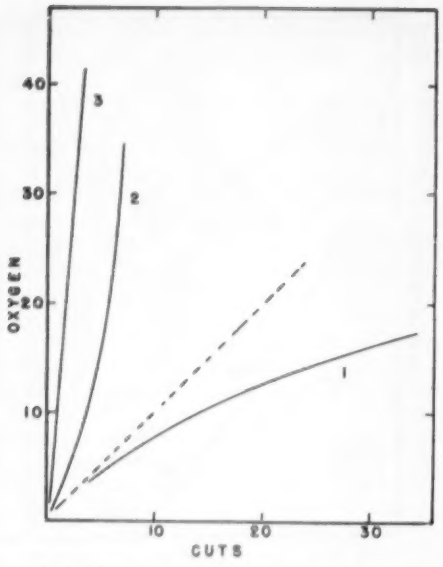


FIG. 10—Oxygen required for scission in vulcanized rubber (see text). Units: moles/10^6 g.

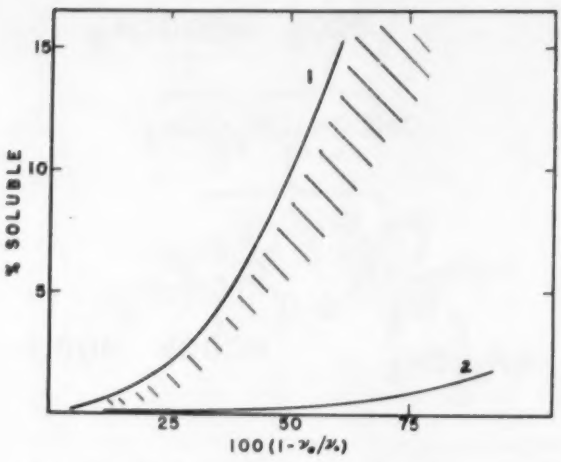


FIG. 11—Relation between solubility and swelling of oxidized vulcanized rubber (schematic). Data from Horikx (14).

Curve 1—random scission; Curve 2—crosslink scission; Shaded area—experimental results. ν_e = effective concentration of crosslinks in oxidized rubber, ν_0 the same in starting material.

(29) which relates residual stress and scission for random breaking of chains. Curve 2 is obtained by assuming only crosslinks are broken, in which event scissions are a linear function of stress. Curve 3 is interpolated from results for raw rubber (cf. Figure 5). The dashed line has a slope of one.

From Figure 10 it appears that if random scission is the only source of the stress decrease, it is a highly efficient process, increasing in efficiency as oxidation progresses—a process for which it is somewhat difficult to formulate a mechanism. If, on the other hand, breaks occur only at crosslinks, the amount of oxygen required for scission increases steadily as crosslinks disappear. This is what would be expected, *a priori*, if both hydrocarbon and crosslinks are oxidized, but the latter react more rapidly with oxygen. It is consistent with the marked effect of combined sulfur on oxygen absorption rates.

Horikx *(14)* has recently published results of an alternative approach to the problem of estimating scission efficiency. Making use of expressions developed by Charlesby which relate molecular weight and crosslink density with solubility and swelling in a solvent of three dimensional networks, he has shown that the relation between swelling of the gel and the soluble fraction of an oxidized vulcanized rubber can be calculated. The relation is quite different, if scission is restricted to crosslinks, from that existing if random scission predominates. Horikx's results are redrawn schematically in Figure 11, in which the solid curve 1 is the predicted curve for random scission, curve 2 for crosslink scission. Experimental data for a sulfur vulcanizate lie in the shaded region. From this it may be concluded that crosslink scission, if it occurs, is of minor significance compared with random cutting of the hydrocarbon.

Although it has been suggested that stress relaxation does not measure the same thing as solubility and swelling measurements, it is not yet necessary to invoke a difference in mechanism to resolve this apparent paradox. There is no question that scission of the hydrocarbon does occur during oxidation at the temperatures of these experiments. At least three of the volatile products found on oxidation of raw rubber—water, carbon dioxide, and levulinaldehyde—are also found when vulcanized rubber is oxidized *(1, 7)*. On the other hand, there is also no question that combined sulfur greatly accelerates oxygen absorption. The yield of levulinaldehyde is said to decrease with increasing combined sulfur *(30)* and the ratio of CO_2 produced to oxygen absorbed is less in vulcanized than in raw rubber *(7)*.

Taken together, these results indicate that both crosslinks and the chains between are involved in reactions leading to scission. The mechanism of chain scission at points remote from crosslinks is presumably the same as that in raw rubber; that at crosslinks remains to be elucidated. Horikx has pointed out that his results are equally consistent with scission at random and with scission at (but not of) crosslinks, which appears a reasonable interpretation of the available results.

Since this paper was written I have had the opportunity to discuss this point with J. P. Berry, who has come independently to the conclusion that scission occurs in the hydrocarbon chain by a process strongly influenced by the crosslink as a result of his detailed study of the relaxation of sulfur-cured vulcanizates.

SPECIAL NOTES

The work leading to the results reviewed here has received constant interest and encouragement from Dr. J. McGavack, who made the initial observations on the effect of oxygen on Hevea latex *(31)* from which this program originated.

(Literature references will be found on the following page)

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Cone Drive Handles 18,000 Pounds of Belting

AN especially smooth drive to handle 18,000 pounds of bulky conveyor belting was required by the Quaker Rubber Co. at its Philadelphia, Penna., plant when it recently installed new 25-foot hydraulic platen presses to fabricate continuous conveyor belting. The belting, up to 72 inches in width and 400 feet in length, is pulled off the hot press and wound about the core of a take-up reel. Drive to handle an anticipated maximum belt pull of 2800 pounds, winding from 20 to 60 fpm, is provided by an efficient Cone-Drive double-enveloping worm gear speed reducer, a product of the Cone-Drive Gears Division, Michigan Tool Co., Detroit, Mich.

Space limitations required an extremely compact drive with high-load capacity to keep the belting under an average tension of 1200 pounds. The double-enveloping "wrap-around" design of the gears in the reducer permit full-depth engagement of the teeth, thus reducing size of gears of housing. As a result, a center distance of only 7 inches was required. Reduction ratio of the Michigan Tool unit is 40:1 with input power supplied by a 7½ hp motor.

The combination of a four-speed transmission, reducer and clutch permits a gradual pull-off. When beginning to wind onto the core, the transmission is set in first gear, its highest ratio. Winding 25 feet at a time as each press cycle is completed, the clutch is slipped through about ¼ of the wind-up. The operator then resets the transmission to second gear, the take-up clutch operating with less slip than formerly. This process is repeated through the fourth gear setting until the take-up reel has attained its largest diameter, clutch slippage again being nearly continuous.

Methods of Overcoming "Wicking" in Rubber Hose

WHEN the unprotected end of a rubber hose is placed in a liquid, such as in a barrel of gasoline, "wicking" may occur that will shorten the effective life of the hose. The liquid will travel up the fibers of the reinforcement of the hose by capillary action similar to the action of kerosene traveling up the wick of the old-time kerosene lamp.

The liquid will attack and weaken the fibers for a considerable distance from the exposed end. "Wicking" may even cause the hose end to swell and eventually to fail. According to recommendations of field engineers of the Thermoid Company of Trenton, N. J., the simplest way to overcome "wicking" is to couple a length of metal pipe on the hose end long enough to prevent contact of the hose end with the liquid. The pipe should, of course, be inserted into the hose and not over the outside cover.

Another easy way to avoid "wicking" is to use a standard metal end protector which will seal the end against contact with the liquid. A third possibility is the use of a liquid neoprene compound which dries in a durable film over the end of the hose and prevents the entry of liquids into the fibers of the carcass. A fourth possibility is dipping the end of the hose in shellac to form a film over the end of the hose. This is only good for water applications and should not be used with strong solvents.

Latest Developments in Mechanical Rubber Goods

A Report on a Symposium Held by the New York Rubber Group at the Henry Hudson Hotel in New York City on October 5

A SYMPOSIUM on the "Latest Developments in Mechanical Rubber Goods" featured the Fall Meeting of the New York Rubber Group, which was held at the Henry Hudson Hotel in New York City on Friday, October 5, 1956. The symposium featured short talks on six specific subjects which was followed by an extensive question-and-answer period. The questions were secured in advance by mail and were submitted to the panelists for prepared answers. Several of the answers also represented the composite thinking of the panelists as a group.

The six subjects covered, and the panelists handling them, were as follows: *Small Molded Goods,* C. A. Sobierajski (U. S. Rubber Co.); *Belting,* William L. White (Manhattan Rubber); *Hose,* J. A. Muller (Thermoid); *Cellular Goods,* George R. Sprague (Goodrich Sponge Products); *Machinery and Equipment,* E. H. Johnson (Farrel-Birmingham); *Reinforcement,* B. B. Boonstra (Godfrey L. Cabot). Mr. Sobierajski replaced L. Cranston and Dr. Boonstra replaced F. Amon, both of whom were originally scheduled. M. E. Lerner (RUBBER AGE) acted as moderator.

The talks made by the panelists, as well as the questions-and-answers, arranged by subject, follow herewith.

Latest Developments in Rubber Belting

By WILLIAM L. WHITE

Director of Research and Product Design, Manhattan Rubber Division, Raybestos-Manhattan, Inc., Passaic, N. J.

BELTS may be divided into two general classes: power transmission belts and conveyor belts. Power transmission belts may be flat belts made of either cord or woven fabrics and the V-belt type of transmission belts or a combination of both. This field is so broad that I can only hope to do nothing more than to mention it. I will, therefore, confine my remarks to conveyor belts.

Conveyor belts maintain the same fundamental principles employed in operation as were used in the very first conveyor belt ever made. Of course, there have been many important and essential refinements in the belts themselves and the structures over which they operate. The two essential components of a conveyor belt are the strength members and the rubber compounds employed. Since my subject is confined to the latest development in conveyor belts I have no choice but to speak on the development that has been made in the past decade in the strength members used in conveyor belts, and I must say that these improvements in strength members have been more essential to the development of the potentials of conveyor belts than have been the developments of the rubber compounds, important as the latter are.

The conveyor belt has been described as an endless belt operating on load-carrying pulleys in either a flat or trough position. It has proven to be a most effective means of transporting bulk or packaged materials over a short distance.

The limitations of conveyor belts have been its load carrying capacity and the distance over which it could operate. To a very large degree this meant that the draw bar strength capacity of the strength member was the limiting factor of the conveyor belt.

I can well remember when 36 oz. cotton duck was the heaviest, strongest available fabric for use in conveyor belts. This belt was made endless with metallic fasteners, and its draw bar rating was about 35 lbs. per inch per ply. As the years went by the strength and size of ducks were increased until finally we reached about 48 oz. ducks. The vulcanized splice was devised, and this increased the range of capacity of the belts. With these improvements the rating could be increased to 60 lbs. per inch per ply, but a 5 ply belt was perhaps the maximum number of plies that could be used in a 36-inch wide belt. This meant that the maximum draw bar capacity for a 36-inch belt was about 300 lbs. per inch of width. This limit was maintained for many years. Many belt engineers and users violently and loudly proclaimed that this was the ultimate in conveyor belt possibilities.

Goodyear Tire and Rubber Company was the first to break through this barrier. They conceived and designed a belt using a single layer of stranded steel cable wire as the strength member rather than multiple numbers of plies of fabric. This belt was designed to have a capacity of 1200 lbs. per inch of width of belt, just about four times the former 300 lb. limit. They dreamed of even belts of 1500 to 2000 lbs. and higher, which was a daring conception. There was no easy step by step method of sneaking up from 300 lbs. capacity to 1200. The only way you could determine whether a satisfactory vulcanized joint could be made was to actually make a joint on a belt loaded to this 1200 lb. capacity.

This meant that first they must devise methods for producing such a belt and methods of making the belt endless. Second, they must find some user who would be willing to redesign his entire operations, providing

new structural members and so forth. His methods of operation would be entirely changed. The belt alone would cost perhaps $100,000 to $150,000, to say nothing of the additional changes which the user must make. But perhaps the most difficult job was to convince the user that he should be the pioneer who would try out the very first belt made with this vastly increased capacity when his whole operation depended on the success of such a new concept.

I have always doffed my hat in respect to Goodyear's engineering and daring, and the salesmanship that made this first belt possible. Improvements have been made in these belts and still other improvements will probably be made in the future, but perhaps the most important result from all of this was that it opened up a whole new field of possibilities for conveyor belt operation.

For example, there was a wide field of belt application where the draw bar requirements were somewhere between the limitations of the old cotton fabric strength member and the new steel cord belt. It was in this field that step by step progress could be made, and it is here where the subsequent improvements have followed. Efforts were intensified to increase the strength of cotton fabrics and investigations were started to determine the possibilities of the use of fabrics made from synthetic fibers. Rayon cord had already made great strides in replacing cotton in tires. Rayon was tried in both woven fabrics and cords. The old question of moisture in rayon plagued all of these early attempts, and some actual difficulties were experienced in field service. Nevertheless, these experimental belts did prove the potential of the use of rayon in conveyor belts.

Other experiments were launched using a fabric with cotton warp and nylon fillers. Belts made from this fabric increased the rip resistance and resulted in better troughing. Other tests were made with fabrics using rayon warps and nylon fillers. All of the belts made with these new fabrics showed that very substantial improvements in the strength members of conveyor belts were possible.

Since these earlier experiments, the rayon manufacturers have made steady progress in the improvement of their filament, better weaves of the fabrics have been designed, and better treatments have been developed to secure good adhesion of rubber to fabric. Today, fabrics made of these synthetic fibers have been designed that will increase the ratings of fabrics to as high as 200 lbs. per inch per ply. Several types of high tension belts have been designed and are in use employing cord fabrics instead of woven fabrics.

To date, rayon has predominated in the race of synthetic fibers, but real strides have been made with Dacron, Fortisan, and other synthetic fibers. As we all know, there is a battle raging between nylon and rayon in the tire field, and the results of this race will have some bearing on the fibers used in conveyor belts of the future.

We have in the past ten years seen the potential length of conveyor belts increase 400 or 500%, and the end is not in sight. Today, belts can be made with fibers that will compete very favorably with steel cord belts in many places. The dream of conveyor belts replacing the railroad as a means of transportation of bulk materials is no longer the wild dream it once was. We now have conveyor belts being used to transport people as well as bulk materials, and the day is not too far off when belts will probably be widely used in airports, parking lots, and perhaps even to replace some type of subway service.

There is an old saying, "Only a fool or a stranger tries to predict the weather in Texas". I am sure this same can be claimed for the prophets who will attempt to predict what will be the final limits of conveyor belts.

Latest Developments in Rubber Hose

By J. A. MULLER

Director of Research and Development, Thermoid Co., Trenton, N. J.

FOR years huge tonnages of liquids have been pumped over considerable distances through industrial rubber hose. Today, advances in rubber chemistry have greatly enlarged the usefulness of hose to the point where it has become an important carrier of solids as well. In addition, rubber hose now can handle more liquids than ever before. This is because of new rubber compounds —compounds that will resist attack by oil, butane, propane, acetylene, insecticides, paints, lacquers, mild acids, anhydrous ammonia and other chemicals. Still other improvements provide hose with greater latitude as far as operating pressure is concerned. Rayon, nylon and steel impart greater bursting strength than was possible even a few years ago. Improved couplings and flanges make the over-all system more efficient.

Thus, the material that at one time ruled out the use of rubber hose can now be handled with ease—even if it is to be carried in a solution containing a petroleum product. For example, here are but a few of the jobs in the handling of solids and semi-solids that are now being performed by rubber hose:

1. Asphalt at 400° F. mixed with sand is pumped through hose.

2. Roofing material composed of hot tar, sand and pebbles is pumped from a central mixing station to point of use.

3. Refined cement rock is pumped along a one-half mile pier in a rubber hose which is moved from hold to hold in the ships and up and down according to changes in the tide by means of a boom.

4. In the loading and unloading of railroad box cars of grains, pneumatic systems using hose represents an improvement in time and spillage over hand and batch methods.

5. Rock dusting in coal mines is performed efficiently by hose, making it possible to carry the dust into each crack and crevice in an irregular surface.

6. Plaster is mixed in a central place in large quantities and is sprayed on walls at a distance from the mixing station.

7. Insulation is pumped into hard-to-reach places.

8. Crushed ice is sprayed into railroad cars to preserve perishable goods.

9. Fish are pumped through hose when unloading fish boats.

This list of applications will expand as times goes on and the handling engineer discovers other uses for hose with its new-found ability to handle a greater variety of

materials. But, before successful applications can be made, a basic knowledge of the standard rubber hose, which consists of an inner tube, a carcass of fabric, cord or wire, and a cover, is required.

The composition of the inner tube determines what material can be carried. The kind and the thickness (number of plies) of the carcass limits the pressure the hose can stand. The cover is designed to withstand the various working conditions in industry.

The simplest rubber hose consists of rubber only and is generally used to carry water or air at low pressure. In a hose of this type, the tube, carcass and cover are all one. For greater pressures, hose is reinforced with cotton, rayon, nylon or steel, wound or braided around the tube. The higher the pressure, the more reinforcement is required. In cases of extremely high temperatures of the material being carried or of the working environment, asbestos may be incorporated in the carcass.

The carcass also enables the hose to withstand excessive deformation under service conditions. In some cases, wire reinforcement is interwoven in the carcass to prevent collapse instead of burst-resistance. This type of hose is used mainly in unloading liquids such as fuel oil from trucks. The hose is carried on a reel from which it is unwound to reach the tank. Such a hose is seldom completely unwound. The pressure of many layers of hose on the reel would flatten the hose making passage of liquids difficult or impossible unless the hose were reinforced to hold its round shape under all conditions. This type of hose is also employed in returning fluid to the pump in hydraulic systems, such as are used in industrial fork-lift trucks.

To protect the tube and the carcass, the hose must have a cover. Not only does it help to identify the hose and make for better appearance, the cover affords the hose protection from moisture, abrasion, oil, impact and sunlight. What is true of rubber compounds available for tubes is also true for covers. Many more compounding ingredients are available today than a few years ago. Better resistance to wear, petroleum products, sunlight and cuts can now be built into the cover because of these advantages.

Influence of Use on Selection of Material

With a basic knowledge of the hose parts—tube, carcass and cover—it is easy to understand how the parts will be affected by the application for which the hose is selected. Rubber chemistry as it applies to industrial hose is a compromise which must take several factors into account. For instance, an ideal materials handling hose for carrying an abrasive solid in water solution or as a solid would have a tube of pure gum rubber because gum rubber stretches and springs back into place after being hit by a solid particle. However, if the material contains any petroleum products, a change must be incorporated in the elastomer to resist attack by the grease, gasoline or oil. This, in turn, reduces the resistance of the tube to abrasion, so that a compromise must be made. The result might be a special hose.

There are a number of special hoses available for special purposes. However, the trend is toward standardization and reduction in the number of hose types. With the advances in hose technology it is quite possible that an application considered special by the user may be handled by a standard hose. For this reason it is wise to consult the hose manufacturer. While not all applications can be solved by a standard hose, many can be handled with minor changes.

Most important in the process of selecting a hose are certain facts pertaining to the material to be carried by the hose and the physical conditions surrounding its operation (see Rubber Hose Selection Guide). Seven of the more important selection factors are discussed below.

Specific Points to be Considered

Material to Be Carried: The first question is will the hose withstand attack from the material carried. While water represents no problem and can be carried in a tube of general-purpose rubber, such items as oil, grease and other petroleum products will require a synthetic tube such as neoprene or one of the nitrile rubbers. Neoprene-type rubbers have resistance to solvents, aging and burning. If a strong solvent, such as benzol or one of various paint sprays or thinners is to be carried by hose, then a special polymer—Thiokol—will be required. For the more abrasive materials, a thicker tube of pure gum stock is necessary; the thickness of the tube will be dictated by materials' abrasiveness.

Pressure: The carcass of the hose resists pressure. The more pressure, the more braids of reinforcement and the stronger the steel, cotton or rayon strands must be. But, this increased weight restricts the bending radius and increases the cost. Thought also should be given to the pressure limits placed upon the hose by the manufacturer. While some hoses may handle extra pressure, an unexpected failure could result in injury to personnel, damage to equipment and a loss of production. Even though normal pressures may be low in a given instance, heavy pulsating or surge loads may make a stronger carcass necessary.

Temperature: The temperature of the material being carried and the ambient temperatures should be considered. Low and high temperatures must be compensated for by special rubber compounds and constructions.

Capacity: The inside diameter of the hose determines its carrying capacity. If the diameter is too small, volume will be restricted; too large means low pressure and unnecessary expense.

Length: Too short a hose results in stretching, while excessive length increases the chance of kinking. Stretching not only weakens a hose but puts unnecessary strain on the couplings. Torsional or twisting strains should be avoided, especially in short lengths of hose. Twisting will tend to separate the reinforcement from the tube and cover. It may even seriously disarrange the reinforcement. The bending radius of a hose should be considered when designing a system involving a long hose that is supported off the ground or floor. All too often a thin metal projection or bracket is used to support hose which causes a bend exceeding the allowable bending radius. The hose is weakened and may fail at the points of suspension. As a general rule, a hose may be bent in a radius of one foot for every inch of inside diameter. Use a wide "saddle" support to keep the bending radius within allowable limits.

Couplings: The hose system is only as good as its couplings. Even the best hose cannot operate with incorrect, improperly applied couplings. In high pressure systems they become critical. Many types are available for general and specific use. Suction or negative pressure systems require a suction-type coupling, while high pressure applications take the interlocking clamp type.

Service Conditions: The cover of the hose must be compounded to resist several elements in the working environment. If the hose is to be used outside where it will be exposed to sunlight, chemicals to re-

sist deterioration by sunlight must be put into the cover. Resistance to oil and grease must be considered if present. After proper selection has been made, the next factor of importance is maintenance.

Maintenance begins as soon as the roll or length of hose is received from the railroad or truck line. If the hose is not being used immediately, store inside out of direct sunlight in the manufacturer's original wrappings. Do not unwrap and leave the roll outside.

When the hose is to be used, unwrap and uncrate carefully. Do not slash at the bindings with a knife; you may cut gashes in the new hose. If delivered uncoupled, make sure the correct type and size of couplings are used. Check the length required before cutting. Use a sharp cutting tool and cut the hose square. Make sure the coupling is properly placed on the hose, that it is inserted all the way in, that the securing clamps or other devices are tightened. If the volume of coupling is large, a hose shop should be set up with proper tools and suitable personnel trained. If your organization uses thousands of feet of hose regularly, the value of a hose installation and maintenance crew should be investigated.

Although anti-oxidants are put into all modern hose covers, oxidation remains the principal enemy of rubber hose. Strong, direct sunlight speeds up oxidation and should be avoided. A particularly bad offender is ozone (0_3) which occurs to some extent at high altitudes and in harmful concentrations near high voltage equipment.

RUBBER HOSE SELECTION GUIDE

Consideration should be given to these factors when selecting hose for a specific application.

1. Material to be carried:
   - A. Volume.
   - B. Pressure (positive or negative).
   - C. Temperature.
   - D. Relative abrasiveness, hardness, sharpness.
   - E. Range of particle size.
   - F. Percent solids, if a slurry.
   - G. Acids, petroleum products, solvents present in material, poisonous.
2. Physical conditions surrounding use:
   - A. Material pumped or forced through hose.
   - B. Distances involved—horizontal and vertical.
   - C. Machinery, containers, vats, processes connected by hose.
   - D. Inside or outside use (sunlight).
   - E. Ambient temperature.
   - F. Hazards present in area—falling rocks, vehicles, high voltage electrical machinery, gasoline, grease, oil, hot pipes.
   - G. Cycle of operation:
     1. Valves shut off quickly and often.
     2. Hose disconnected frequently.
     3. Moved frequently—how moved.
     4. Not used for long periods.
   - H. Nature of surface hose will rest on.
   - I. Ambient pressure range.

Latest Developments in Expanded Rubber

By GEORGE R. SPRAGUE

Director of Research, B. F. Goodrich Sponge Products Division, B. F. Goodrich Co., Shelton, Conn.

BEFORE embarking on the latest developments in the production of expanded rubbers, I should like to clarify the term expanded rubbers. The field is so broad that I like to break it down in the following manner:

1. Foam—made from a liquid system generally having a larger degree of open (interconnecting) cells. These foams may be of natural or synthetic latex, of vinyl plastisol, or of isocyanate (polyester or polyether) foams.
2. Sponge—made essentially from a rubbery elastomer processed on conventional dry rubber equipment and having a large degree of interconnecting cells.
3. Closed cell expanded products—consisting of a majority of non-interconnecting cells which may be made from a liquid system as vinyl plastisols or rubbery polymers as used in making sponge.

Each group have their own properties with, of course, some overlapping. They range in compression from very soft products, such as foam pillows, to hard rubber expanded closed cell carburator floats; high or low oil resistance; retention of properties at either or both high or low temperature; poor to excellent sunlight and ozone resistance, and many other specific customer required properties.

I cannot begin to enumerate and explain the vast number of new developments in these three categories so I will stick with the fields I know best, namely, sponge and closed cell expanded products.

The latest developments in the production of expanded rubbers may be drawn into four categories: elastomeric materials, blowing agents, curing systems and filler materials.

Prior to World War II, natural rubber was used almost exclusively. During and immediately after the War, GR-S, neoprene, the acrylonitriles and butyl rubber came into prominence. Now, in addition, the rubber chemist has new tailor-made polymers to work with, such as the silicone rubbers, Hypalon, polyacrylate, butadiene-methyl vinyl pyridene, and improved GR-S, neoprene and nitrile polymers. All of the aforementioned elastomers may be successfully made into sponge or closed cell products.

To make expanded products, a gas of some kind must be generated. For open cell articles, carbon dioxide, ammonia and nitrogen usually were generated by sodium bicarbonate, ammonium bicarbonate, urea and blends. Now, particle size and blowing power of soda has been improved by dispersion in oil (Unicel S) producing finer cells with less blowing agent.

The greatest advances have been in nitrogen generating chemicals, mostly used in closed cell articles, with improved cell size and less odor. These new materials are non-staining, non-blooming and are more economical. Each chemist probably has his own favorites for specific compounds.

In relation to curing temperatures, there are the rela-

tively low temperature blowing agents of the decomposition type, 180° to 230°F., such as Selogen OT, Porophor BSH and Porophor N; in the medium range, 230° to 280°F., there are Unicel ND, Opex 40, Vulcacel BN and BL 353; in the high temperature range, 280° to 340°F., we have Celogen AZ and Genitron AC. It must be pointed out that acid and alkaline chemicals (kickers) can be used to reduce or tailor-make the decomposition temperature of any of these blowing agents to suit any manufacturers' particular compound and curing system.

New developments in curing systems are adding exciting tools to the rubber chemists' portfolio. The advent of new polymers has spurred thinking away from conventional sulfur-accelerator combinations toward cross-linking agents, such as dicumyl peroxide, ditertiary butyl peroxide, tetraethylene tetramine, pentamethylene tetramine, tribasic lead maleate, etc. Excellent sponge and closed cell products may be made employing these curing agents.

Recent filler materials that have played a very important role in expanded shoe soling are the reinforcing silicas: Silene EF, Hi-Sil, Zeolex and other modifications. These fillers in conjunction with high styrene resins give soling which has excellent hardness, toughness and is lightweight. Specialized silicas, such as the Santocels, Cab-O-Sil and Valron, have advanced the use of silicone elastomers markedly.

Since every company engaged in the manufacture of expanded products has its own special production techniques and compounding secrets, it hardly behooves me to talk about specific compounding, equipment and processes. The basic formulas contained in the technical bulletins issued by the suppliers are generally excellent starting points. However, it may be of interest to preview some of the properties of the newer polymers.

Both open and closed cell products can be made from the silicone rubbers using either ditertiary butyl peroxide or dicumyl peroxide for cross-linking. Generally speaking, blowing agents with as neutral a pH as possible are preferred. Many manufacturers are getting away from proprietary compounds as supplied by silicone rubber manufacturers and are compounding directly from gums such as G.E. 76 (methyl silicone), Linde 97 (vinyl methyl silicone) and G.E. 51 and Dow 440 (phenyl methyl silicone). In sponge products, the G.E. 76 and Linde 97 gums are good general-purpose gums which give articles good to +500°F., though their low temperature properties are not too good below −40°F. Excellent compression sets are obtained with Linde 97. G.E. 51 and Dow 440 give excellent low temperature properties even to −100°F. but high temperature drop to about +450°F.

Hypalon makes very nice open and closed cell articles which have outstanding ozone and sunlight resistance, excellent color retention, and good physical and chemical properties. Cures may be effected using conventional acceleration, tribasic lead maleate, or dicumyl peroxide. Gas retention of closed cell material is very good. One of the most interesting avenues of pursuit is the use of Hypalon in blends with other polymers, including GR-S, neoprene, butyl rubber and natural rubber.

Polyacrylates, as exemplified by Hycar 4021, can be used as open or closed cell articles where oil resistance and heat resistance up to 350 to 400°F. are required. Their low temperature properties are very poor below −20°F. Excellent compression set properties may be realized using amines such as tetraethylene tetramine or pentaethylene tetramine either alone or in conjunction with Trimene Base or hexamethylene tetramine.

Butadiene methyl vinyl pyridene is one of the newest polymers we have been working with. Our work has been limited to open celled sponge, and outstanding properties, the retention of excellent tensile strength and good elongation at testing temperature of 200°F. and prolonged time are manifest. Cure is effected using sulfur and conventional accelerators. Products of this material may be used in contact with rocket fuels.

While I have mentioned some of the newer exciting polymers, they are specialty products. The bulk of commercial expanded products, due largely to their price advantages and familiarity of compounding, are natural rubber, GR-S and neoprene. Blends of nitriles and vinyl, nitriles and phenolics, and GR-S and styrene resins, especially the latter, are increasing rapidly in sales potential. I predict Butyl with its price advantage will come into prominence as more concentrated compounding efforts take place.

The over-all market for expanded products—foam, open and closed cell rubbers and plastics—is ever growing and as a group is surpassed only by tires and tire products in long ton consumption.

Latest Developments in Small Molded Goods

By C. A. SOBIERAJSKI

Development Department, Mechanical Goods Division, U. S. Rubber Co., Passaic, N. J.

THE manufacture of small molded goods can be accomplished by using several molding methods. These consist of compression, transfer, injection, full injection and inflatable molding. The compression mold is further divided into flash type, positive or plunger and semi-positive. The choice of method is largely dictated by economics. The flash compression mold is the least expensive and is the type most widely used. Transfer molds can cost as much as 50% more than the equivalent compression type molds. The advantages of molding complex shapes or articles containing inserts outweigh the added costs. Full injection molding is most suitable for small items having thin walls and complicated shapes. The high production rate makes this method most efficient on large volume production.

Mold design must take many factors into consideration. The molding method selected depends on the anticipated volume of production; size, shape and complexity of the item to be molded; the presence of inserts, and finish. Close tolerances, complex shapes, sharp corners and deep undercuts are uneconomical and frequently can be avoided without sacrificing serviceability of the final product.

Small molded goods, for the most part, are highly com-

petitive items and therefore the most economical manufacturing methods must be utilized. Individual piece loading of prepared stock per cavity in compression molding can be supplemented by sheet loading for numerous cavities or pellet loading. Where this is not possible, especially on articles requiring complicated build-up, transfer and injection molding can be used to charge the mold cavities by placing a single piece of prepared stock in an injection pot or using an extrusion unit. Molding small parts in sheet or strip form in compression molding facilitates removal from the mold and makes possible automatic or semi-automatic trimming by feeding strips into trimming or punching machines to remove flash. Sometimes entire sheets can be trimmed by using gang dies. Transfer and injection molds can be closely machined to make trimless parts with a fuzz flash which in many cases is not objectionable. If it is, it can be removed by dry ice tumbling.

Shorter Cure and Closer Control Possible

Shorter cures have been effected through use of ultra accelerators. Closer controls on cures have been possible with automatic timers which not only control length of cure but also the "bumping" or "breathing" cycles on compression molds. Change cycles to remove the molded part and reload the mold with uncured stock have been shortened through use of ejector pins, stripping plates and loading jigs. To reduce chilling and maintain molding temperatures of molds during change cycles, wherever possible, the mold plates are steam jacketed or electric cartridge heaters are inserted.

Sampling procedures can be applied to inspection of certain molded items without sacrificing quality to effect further economies. The extent of savings realized using sampling inspection can be substantial. A study of statistical analysis and sampling technique, however, should be made to establish proper quality limits.

The choice of elastomers for small molded goods depends to a large extent on the properties desired and the end use to which the parts will be subjected. Natural rubber still predominates as the first choice. More than half of the volume of elastomers consumed consists of natural rubber and GR-S combined. The amount of each fluctuates with the price situation. The oil-resistant elastomers—neoprene and nitrile rubbers—comprise less than half of the volume. Butyl rubber consumption is approximately 2% of the total volume. Both natural rubber and GR-S probably will continue to supply the bulk of the requirements for molded goods for many years.

With all the advances made in polymer chemistry, the industry is still looking for the ideal synthetic rubber for molded goods use. This ideal synthetic rubber would have to possess all of the desirable physical properties of natural rubber plus good oil resistance and good high temperature resistance. It would also be desirable if it had the same processing and molding characteristics as natural rubber. Butyl rubber, if it had good oil resistance, probably would closest approach this ideal synthetic.

Butyl rubber is one of the lowest priced elastomers available to the rubber industry and potentially has a bright future in molded goods. It has good physical properties combined with good aging, good chemical resistance, low gas permeability, electrical insulation characteristics and good low temperature brittleness. High temperature mixing of butyl rubber greatly improves processability and molding. Brominated butyl rubber now provides compatability with other elastomers, good adhesion to metals and other polymers and a faster curing rate than regular butyl rubber.

The oil-resistant elastomers have steadily increased in use during the past 15 years. Major use of these elastomers has been in oil field applications. Other uses include seals, gaskets, boots and diaphragms. Requirements for resistance to oils containing moderate amounts of aromatics, heat resistance up to 275°F., weather resistance and low temperature flexibility to −65°F. can be met satisfactorily using one of the oil-resistant elastomers.

The newer elastomers have been limited in their use to military applications where demands have been greatest for rubbers having good oil resistance and flexibility at both high and low temperatures. Initial acceptance for non-military uses has taken place on automotive parts. This should follow with refrigeration, electronics and chemical applications. The present non-military applications have been for gaskets and seals at high and low temperatures, and seals and liners requiring chemical resistance. The American Society for Testing Materials has adopted in their Specification D-735 requirements for exposure to abnormal temperatures and compounded oils. Class TA specifies materials having maximum resistance to the effects of both high and low temperatures. Class TB specifies materials having outstanding resistance to both dry heat and oils at high temperatures.

Of the new elastomers, silicone rubber has found the widest acceptance. It is resistant to temperature extremes and properties remain constant from −60° to +500°F. It is unsuitable for aromatic oils, fuels and abrasion. A recent development, a fluoro-silicone rubber, combines the wide temperature range of the silicone rubbers with outstanding resistance to swelling in contact with aromatic oils and fuels. Its availability, however, is limited for essential Air Force applications.

Hypalon rubber, a chlorosulfonated polyethylene, has good weather, heat, ozone and chemical resistance, but is unsuitable for aromatic oils and most fuels. It offers good color possibilities. The polyacrylates offer heat resistance, water resistance and fair to excellent oil resistance. They are unsuitable for exposure to low temperatures but the high limit is 400°F. The vinylpyridines have from fair to excellent oil resistance and are suitable for temperatures up to 300°F. The low temperature flexibility decreases as the oil resistance increases. The polyurethanes offer superior abrasion resistance plus good oil and ozone resistance but are unsuitable for water applications. To date, the liquid polyurethanes have found wide acceptance for foam products but the solid elastomer still requires considerable experimentation to solve processing difficulties.

Fluorinated Elastomers

Perhaps the most interesting elastomers are the fluorinated elastomers which are resistant to oxidizing acids, fuels containing up to 30% aromatics, ozone, weather and lubricating oils. Kel-F Elastomer, a copolymer of trifluoroethylene, is satisfactory for −60° to +450°F. and Poly FBA, a polyfluorobutyl acrylate, is satisfactory for temperatures up to 350°F. and is resistant to diester lubricants.

The newer elastomers are for the most part specialty materials and will find limited application, depending on the service requirements and the properties desired. Their use will increase in years to come but this will largely depend on price. The polymer chemists have met the challenge of upgrading high temperature resistance while maintaining oil resistance, and further developments undoubtedly will come. The molded goods manufacturer is now in a position to supply resilient materials for service requirements unbelievable only a few years ago.

Latest Developments in Reinforcing Pigments

By B. B. BOONSTRA

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SOME 10 years ago it was almost a regular procedure to counter any question on the subject of reinforcement with the question: What do you mean by reinforcement? This would then set off polemics on the definition of reinforcement and a number of ad hoc definitions would be given. In many such cases it appeared that the term reinforcement was used to describe improvement of one particular property, mostly tensile strength.

This has resulted in one school of thought, namely, that reinforcement should always be mentioned in conjunction with the property one had in mind. So there was question about reinforcement of tensile strength or reinforcement of modulus, etc.

That this practice made sense was particularly stressed by the natural rubber technologist who could point out that no vulcanizate compounded with whatsoever pigment could reach the same level of tensile strength as the highest values that could be attained with natural rubber pure gum vulcanizates. This is particularly obvious when the strength is calculated on actual cross-section (tensile product).

When the term "reinforcement" is used nowadays in a general sense the technologist has in mind a complex of mechanical properties, of which tensile strength, tear resistance, modulus, and abrasion resistance are the major ones.

One property which has probably not obtained the recognition it merits to express this complex of values is the energy at rupture—the area under the stress-strain curve as first suggested by Wiegand in the twenties.

In the case of mechanical goods that are used for such a variety of applications, where special properties are of importance in each special case, it may be well to consider reinforcement also from this other point of view, i.e., improvement of one selected property.

Properties and Pigments

For some properties, variation of the polymer is of far greater effect than variation of pigments in the compound. Such properties are:

Swelling or oil resistance.
Heat resistance.
Gas permeability.
Rebound.

The latter two are less specific for the polymer than the first two properties.

In other words, it is senseless to try to improve the oil resistance of a GR-S compound by using an SAF black instead of a soft clay, whereas changing to an acrylonitrile-type rubber would reduce the oil resistance to a much greater extent.

The different types of reinforcing pigments can be classified in the following categories:

Carbon blacks of the various types.
Precipitated silica and silicates.
Fumed silica (alumina, etc.).
Coated inorganic pigments.
Resin-type reinforcing materials.

The reinforcing effect according to the general definition depends on three factors:

(1) Extent of surface area present in one cm^3 of compound.
(2) Specific interaction per cm^2 of contact area between pigment and polymer.
(3) Tendency of the pigment to form a structure.

Types of Reinforcing Pigments

Carbon Blacks: The carbon blacks are the largest group of reinforcing pigments with a great variety among the different types that combine these properties in various proportions. The variation is so great that not all these types can be discussed here. The highest abrasion resistance is obtained with these pigments and the designation HAF and SAF indicate the blacks that have been developed for this purpose. The latter is particularly useful where conditions are extremely severe. The latest development in this field is the superconductive furnace black which combines high conductivity of its compounds with high abrasion resistance.

Precipitated Silica and Silicates: Precipitated silica and silicates have made great strides in the last few years, particularly the precipitated silica. Inorganic pigments have been produced for some time that imparted tensile values which were comparable with those obtained with carbon blacks, but tear resistance would always be much lower, not to mention abrasion resistance. Nowadays, not only tensiles but also tear resistance values closely approach those of the fine particle size rubber carbon blacks. Abrasion resistance is still on a somewhat lower level but this property is very dependent on the particular application. The silicates have more structure (higher modulus) than the precipitated silica, but still considerably less than the high-structure-type furnace blacks.

Fumed Silica: The fumed silica is a high-class material of fine particle size and high purity. It imparts high tensiles and tear with a characteristic low modulus already at low loadings (10 vol. %). With nitrile rubbers, tensiles may be higher than are obtainable with carbon blacks and tear resistance is as high as with ISAF blacks. Particular application of the fumed silica is in silicone rubber, where resistance to high temperatures is the prime requisite.

Coated Inorganic Pigments: These are not new. Before World War II the Japanese produced Hakuenka, a precipitated $CaCO_3$ with a coating of stearic acid. Calcene TM is a similar product. The coating was primarily intended as a means to incorporate the filler faster in the rubber through better wettability.

Valron Estersil is another example. This DuPont product is a very fine precipitated silica of which the surface OH groups have been reacted with butyl alcohol to form butoxy groups. As a filler for silicone rubber, it imparts outstanding tensile and tear to the stock, but the organic nature of the coating limits the high tem-

perature resistance. Considerable improvement has been made lately in this respect.

In a number of cases, coatings have been tried with the intent to obtain a chemical linkage between the particle and the polymer. We are, however, not at all sure that this would result in a higher reinforcement level. Carried to the extreme, these chemical bonds would serve as so many cross-links and, if the rest of the rubber were sufficiently cured, this would mean an overcure or at least a non-homogeneous distribution of cross-links with resulting lower tensile, tear, and flex resistance.

Resin Reinforcement: The resin-type reinforcing pigments are still in a development stage. Early work has been done in the European institutes for research on natural rubber, mainly in the Institut Francais du Caoutchouc. Tires have been run with treads and sidewalls made from resin-reinforced rubber in various colors to match the automobiles. Drawbacks of the earlier resin compounds were the necessity of special processing and equipment for the compounds (latex casting) and susceptibility of the modulus to deformation (Mullins effect). These properties have been improved considerably now and work on resins is also being done in the United States. The resins form a supplement of the types of reinforcing materials that should be watched with interest.

Latest Developments in Machinery and Equipment

By E. H. JOHNSON

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I HAVE been allotted 10 minutes to talk about equipment for the production of mechanical rubber goods. Needless to say, the talk must be very brief and can cover the high points only. As briefly as possible I shall try to cover the Banbury mixer, rubber mill, extruder, calender and press.

Without doubt, the most notable development in Banbury mixing that has taken place in the past few years is what is generally termed "high pressure mixing". This actually should be termed "high horsepower mixing", since what we are trying to do is get the work into the batch in as short a time as possible by the application of higher horsepower.

This can be done by two methods—either through the use of higher speeds or higher pressures on the batch. Although both factors have some effect on any stock, it appears that speed has a greater effect on the softer stocks, such as plasticized PVC, and pressure has a greater effect on the harder, or stiffer stocks, such as highly loaded rubber compounds.

Normal time cycles can be cut by 30 to 50% through high horsepower mixing, with no sacrifice in quality. In most cases, dispersion is improved, since a large part of the mixing is done while the stock is in its stiffest state.

Although high horsepower mixing has many advantages, it also presents some problems to the machinery manufacturer and the rubber and plastics manufacturer. Since more horsepower will be utilized in a shorter time, a more rugged Banbury and drive is required. For instance, the first No. 11 Banbury was equipped with a 200 hp motor, whereas there is a No. 11 Banbury now in operation with a 1500 hp motor running at triple the speed of the first one. The first No. 3A Banburys were designed to operate with 100 hp motors, but in recent tests in our processing laboratory we have drawn average horsepowers in excess of 1000.

We found that the standard type of dust stops were inadequate for the higher pressures and we designed a dust stop that utilizes the internal pressure to effect a seal rather than have an external pressure resist the internal pressure, as is the case with the conventional type of seal. The time required to discharge the batch becomes an important factor, since it would be foolish to take ½ minute to discharge a batch which took only 1½ minutes to mix. To speed up the discharge time, we designed a drop type door which has a pivoting rather than a sliding action and is operated by an electro-hydraulic mechanism. This type of door is not only faster acting, but is also cleaner and tighter fitting.

The shorter cycles realized by high horsepower mixing makes automatic loading and automatic operation of the Banbury and some means of quickly taking away the stock an absolute necessity. Many systems have been designed and are in use today.

The rubber mill seems to retain its popularity as the "work horse" for many different operations and quite a number are sold each year. The major improvement to the rubber mill has been the addition of the flood lubricating system for the roll neck journals. Practically all the mills purchased today have individual drives, which facilitates their location in the rubber factory to suit the most economical operating arrangement. Without question, the multiple mill line arrangement has died a natural death.

Many small extruders, in sizes from 2 to 6 inches, are used for mechanical goods work, but by far the greatest developments and improvements have been made in the larger sizes from 7 to 20 inches for handling stock directly from the Banbury mixer. A complete line of extruders, strainers, strainer-extruders and pelletizers has been developed for taking the stock from the various size Banburys.

Certain mechanical stocks have to be carefully strained after mixing, and many wire plants now have machines with strainer or strainer-extruder heads taking stock directly from the Banbury. Finished stocks are handled in this manner, but careful consideration must be given to the size of the extruder selected, based on the minimum Banbury mixing cycle, so as to avoid the danger of heat build-up. In other words, the size of the machine and the rpm of the screw become very important factors from a heat control standpoint.

The pelletizer now has been developed with an end discharge head instead of the "high-hat" or side discharge head. The end discharge head can be quickly opened so that masterbatch and finished mix stocks can be pelletized. This ability to clean the pelletizing head and also to handle accelerated stocks opens up a further field in the rubber processing technique. The principal benefits to be gained, however, from pelletizing are primarily in the fields where large volumes of material are handled. Quickness of cooling, cleanliness, ease of handling and weighing out, as well as automatic conveying, are advantages to be gained from pelletizing rubber.

Many new developments and improvements have been made in the design of calenders. These developments and improvements have been brought about by the demands of the plastic film and sheeting producers, who soon discovered, because of handling and fabricating problems, that closer gauge tolerances were required than could be obtained from the ordinary rubber calender.

For example, the modern four-roll plastic film calender is built with the rolls arranged in "Z" formation so as to eliminate roll movement or "float". It is equipped with drilled-type rolls for stable, accurate temperature control by using circulating hot or cold water under pressure. It is equipped with the cross-axis device for compensation for roll deflections and the roll journal bearings are flood lubricated by oil in circulation under proper temperature control.

All of the above features mentioned are incorporated in the design of the three-roll Tri-Angular calender which was designed primarily for the rubber industry for single sheeting and coating and frictioning. A still later development (now in process of manufacture) provides an individual motor drive for each roll so variable roll surface friction can be used to suit the flow characteristics of each particular compound.

All of these features are highly desirable for the calender for the mechanical goods plant, where "variety is the spice of life", because of the designed-in flexibility which eliminates the necessity, to a great extent, of the skillful calender operator who manages, somehow or other, to turn out a commendable job on a calender built 50 years ago. However, the skillful calender operator is gradually disappearing from the scene and the calender must be built so as to eliminate the so-called mysteries which required that certain touch for correction.

The design of presses for the mechanical goods plant is more or less in a static condition, except perhaps for the materials handling equipment built around it. Presses more or less are designed to suit specific applications, and high speed and high pressure operation is not unknown to the industry.

Questions and Answers

Small Molded Goods

(Answers by C. A. Sobierajski)

Question: What is the best method of compounding a light-colored stock of GR-S or natural rubber having the following properties: (1) Water resistance; (2) Shore A 70 to 80; (3) Good tensile strength, and (4) Excellent compression set, comparable to blacks?

Answer: A light-colored GR-S or natural rubber stock having a hardness of 70 to 80 Shore A, water resistance, good tensile strength and excellent compression set can be compounded by using zinc oxide or a combination of clay and zinc oxide for filler and thiazole-guanidine acceleration. If greater processing safety is desired, sulfenamide acceleration can be used.

Question: How can the finish of 40 durometer black neoprene and nitrile rubber extruded stocks be made as smooth as possible?

Answer: The finish of 40 durometer neoprene and nitrile rubber extruded stocks can be made smooth by breaking down the polymer to remove its nerve. Rubber substitutes and processing oils should also be incorporated in the compound.

Question: What are your recommendations for a 50 durometer natural rubber stock resistant to water at 212°F. retaining 75% of original tensile and elongation after 70 hours immersion?

Answer: A 50 durometer natural rubber stock resistant to water at 212°F. retaining 75% of original tensile and elongation after 70 hours immersion should be compounded with black filler and litharge acceleration.

Question: What is the status of dielectric or high frequency heating in molding?

Answer: Dielectric or high frequency heating has found little application in the molding of small rubber parts. It has, however, proven effective in preheating of large preforms with substantial reductions of subsequent curing times.

Question: What effect do mold temperatures and mold pressures have on the quality of finished molded pieces? What are the minimum and maximum variations which can be tolerated in articles of 35 to 75 durometer range items?

Answer: Mold temperatures and mold pressures do not have as pronounced an effect on the quality of finished molded pieces as might be expected. As long as the molding temperature is maintained at a point to permit flow to completely fill the mold cavity before cure begins, then any equivalent cure can be used. Variations in curing temperatures should not exceed ±2° F. for close control of cure. However, ±5° F. variations can be tolerated.

On large volume articles where "backrinding" or "chewing" is experienced, curing at lower temperatures is desirable as less thermal expansion is produced. Preheating the compound to obtain a low temperature differential between the stock and mold will also eliminate "backrinding".

Molding pressure should be equal to or greater than the internal pressure developed by the stock in a mold. Excessive molding pressures are undesirable because mold damage is more likely to occur. Pressure variations should be controlled within ±100 psi, though ±200 psi can be tolerated.

Question: What compounding and processing methods should be used to insure good cured adhesion between plies of GR-S and nitrile rubber, especially open steam cured products?

Answer: Good cured adhesion between plies of GR-S and nitrile rubber is obtained by proper selection of tackifiers and plasticizers. The plies should be assembled while the stock is in a fresh state. If solvents are used to refreshen stock they must be permitted to evaporate completely and the plies assembled when an aggressive tack is present.

Question: What type of cure should be used for a cold GR-S compound containing carbon black to produce the lowest possible compression set? The product must have a Shore durometer of 70 and is presently press cured at about 307°F. for about 7 minutes. In use, it is in contact with hydraulic fluids.

Answer: A cure for a cold GR-S carbon black compound having low compression set can be achieved through thiazole-guanidine acceleration, thiazole-thiuram acceleration and, sometimes, a sulfenamide cure, depending on what other compounding ingredients are used.

Question: How can blisters be eliminated during calendering?

Answer: Blisters can be eliminated during calendering by proper selection of plasticizers and processing agents in compounding a stock and close control of roll temperatures on the calender.

Question: What physical properties are most desired in an automotive shaft seal?

Answer: The physical properties most desired in an automotive shaft seal are oil resistance, good resiliency, low compression set and low hysteresis.

Question: What is the major role of rubber substitutes (Factice) in mechanical goods and how extensively is it used?

Answer: The major role of rubber substitutes in mechanical goods is as a processing aid in soft durometer compounds or as a diluent to reduce cost in harder compounds. They are not used extensively and their limited use predominates in very soft compounds. Rubber substitutes are often used in neoprene friction compounds to obtain good coverage on the second pass.

Question: Can light-colored molded goods be produced with a two minute cure at 300°F.?

Answer: Light-colored molded goods can be produced with a two minute cure at 300° F. through the use of metallic dithiocarbamates as secondary accelerators with thiazoles as primary accelerators or by using metallic dithiocarbamates as primary accelerators. However, their use reduces processing safety and scorching may be encountered.

Question: In molded rubber products, what is the most satisfactory preform volume for any given volume of finished, vulcanized products? How should this be adjusted, if necessary, for various types of mold design, product size, and elastomer compounds?

Answer: The preform volume depends on the product size and the mold design. With compression molds, it usually is 10 to 20% more than the product volume. Plunger type molds require lower preform volumes, but these must be more accurately controlled. With transfer injection molds, the preform volumes depend on the product size. Articles under ½ inch may require a preform volume as much as 100% in excess of the product volume. Those measuring ½ inch to 4 inches require 30 to 50% excess volume and articles over 4 inches require 15 to 25% excess volume.

Question: What is a good curing system for a natural rubber stock similar to a tread stock, except that very good high temperature aging properties are required?

Answer: A good curing system for a natural rubber tread stock having good high temperature aging properties consists of low sulfur or sulfurless acceleration using thiuram disulfides or selenium dithiocarbamates. Antioxidants imparting heat resistance should also be incorporated in the stock.

Question: What percentage of defectives would be considered reasonable in the volume production of the following items: (1) Automotive Brake Cups; (2) Milking Inflations, and (3) Pump Diaphragms.

Answer: The percentage of defectives considered reasonable for volume production varies, dependent upon the method of molding. Automotive brake cups have a defective rate of 5% for injection molding and as high as 15% with compression molding and subsequent trimming to obtain a sharp edge. Milking inflations defectives vary from 5% to 10% depending on molding method. Pump diaphragms defectives are approximately 10%.

Question: Is there a noticeable difference in a whole tire reclaim mechanical stock made by the pan, digester, or continuous reclaimator process? Is there a preference? Which would give highest physicals and best aging?

Answer: As a whole, there is no appreciable difference in whole tire reclaim mechanical stocks made by the pan, digester or continuous reclaimator process providing proper adjustments in acceleration are made depending on the accelerating effect of the reclaim. There should be no preference and equivalent physicals and aging properties should be obtained.

Question: What is the current role of brominated butyl in mechanical rubber goods? How do the compounding principles differ from those employed with regular types of butyl rubber?

Answer: Brominated butyl rubber is finding limited use in mechanical goods. Its desirable features of faster cure rate than conventional butyl rubber, compatability with other polymers, and ability to bond to metals and other elastomers should increase its use. Because of its faster curing rate considerably less accelerator should be used.

Question: Has the automotive industry expressed a desire to use nonflammable hydraulic fluids in future cars? What have the mechanical rubber goods people developed for such use?

Answer: To our knowledge the automotive industry has not expressed a desire to use non-flammable hydraulic fluids in future cars. Butyl rubber would have merit for this application.

Rubber Belting

(Answers by W. L. White)

Question: What antioxidant or combination of antioxidants gives the best performance in (a) conveyor belts, (b) V-belts?

Answer: Antioxidants are generally used for one of three purposes: (1) Antioxidants that are designed primarily for good aging, (2) Antioxidants to increase flex life, and (3) Antioxidants that might give

some sunlight protection. All of these antioxidants are influenced both in their function and in the quantities used by the curing system of sulfur acceleration, time and temperature. This means that many various combinations of antioxidants are used depending upon service conditions of the belt and the type of curing system that may be employed.

Conveyor belts: Usually flexing is not a major factor in conveyor belt friction members but flex cracking of covers must be taken into consideration, particularly when GR-S compounds are employed. Natural aging is always a problem, for the life of the conveyor belt may be as long as 15 or 20 years. Many belts are exposed to sunlight. This can be particularly serious if a belt is allowed to stand idle for any protracted length of time and the belt is under strain over the pulleys.

V-belts: Severe flexing requirements are demanded of V-belts. Heat build-up must be avoided as much as possible and antioxidants which give best heat protection are most desired. Combinations of accelerators are required to give the best protection for all of these various demands both in conveyor and V-belts.

Question: What types of adhesives should be used in bonding rubber to metal for tank linings? What are the advantages or disadvantages of metal grit over sand blasting in tank cleaning? Is it possible to degrease before large tanks are lined?

Answer: For hard rubber linings, a hard rubber cement which can be made from a lining itself can be used as an adhesive. For soft natural rubber linings Ty-Ply Q has proven satisfactory as a primer with a secondary natural rubber cement. For soft neoprene or Hycar linings, Ty-Ply S is a good primer with a cement made from the stock as a secondary cement.

Metal grit is preferred generally over sand for cleaning because of the speed with which it will act through rust, mill scale, etc. In a permanent installation, metal grit is to be preferred over sand because it is less dusty. Sand is generally used on large field-lined tanks because it is cheaper than grit. We have found that the adhesive systems mentioned above usually show no difference in bond strength or type of adhesion failure whether sand or shot is used.

While it may be possible to degrease large tanks, we do not believe it to be necessary if care is taken to keep the blasting medium clean and free from grease. If an oily or greasy article is to be blasted, we remove the grease first by "boiling out" in steam in a vulcanizer before the blasting operation.

Question: We purchase and slit 48-inch wide, 300-foot long rolls of 8-ounce duck F.B.S. belt. When slit it invariably has "sweep." Is it possible to eliminate this during manufacture?

Answer: By the term "sweep" we presume it is meant that when a roll of belt has been slit into narrower belts and rolled up then if rerolled out on the floor the belt tends to lie in an arc rather than in a straight line. We know that this condition can occur if a cut edge belt is laid flat on the floor and more moisture absorbed on one side of the belt than on the other. This will cause shrinking of the fabrics on one side and cause the belt to roll out in an arc. This also might be caused if water is used during the slitting of the belt and if more water is absorbed on one side than on the other.

Question: What do you consider to be the most important physical characteristics of a rubber compound for use in V-transmission belting? Can all these be measured in the laboratory?

Answer: The rubber components of a belt are: (1) a base stock, (2) a friction and skim, and (3) an adhesive, if synthetic fibers are used. The characteristics which must be secured are: minimum heat build-up, maximum heat resistance, good flex life, good adhesion, and good cover wear. Obviously, there is no one test which can be applied to determine all of these characteristics and the only satisfactory test we know of is a natural service type of test of the V-belt itself.

Question: How do natural rubber and cold GR-S compare for performance in conveyor belts?

Answer: Natural rubber or mixtures of natural rubber and cold GR-S are quite generally used for frictions and skims in conveyor belts. Both GR-S and natural rubber are used for belt covers. I believe it is generally conceded that natural rubber might be slightly better than cold GR-S for heavy impact, but for lighter service it is a very open question as to which is the better and the economical position of natural rubber and GR-S will certainly play an important part in the selection of polymer to be used at any given time.

Question: What is the best method of branding flat mechanical goods such as transmission belting and also hose. Has silk screening been actually put into production?

Answer: It is not possible to flatly state what is the best method of branding belting or hose. This depends upon the purpose the brand is intended to perform. Actually, there is quite widespread use of branding during cure with rubber brands, decalcomania transfer brands and embossed aluminum brands either plain or rubber-covered. Cured products may be branded by printing, heat-transfer, stencil, and silk screen printing. We do not know of any very extensive use of silk screen printing.

Question: What is practical limitation to length of rubber sheeting that can be rolled on drum for steam vulcanizing?

Answer: We presume this question refers to C.I. or red sheet packings, wrapped thin diaphragm sheet, and the like. The length of such rolls depends, first, on the thickness of the sheeting and wrapper; second, on the diameter of the curing drum; third, on the time and temperature of cure. A very broad general statement is that reasonably satisfactory cures can be secured when the combined thickness of sheeting and wrappers will not exceed 1 to 1¼ inches. This would mean that approximately 40 yards of 1/16-inch C.I. packing can be wrap cured on a 30-inch diameter drum and cured two hours at about 280°.

Question: What percentage of natural rubber versus synthetic is being used in flat belting? If there is a trend to more synthetic, what is the reason?

Answer: Flat belting includes both transmission and conveyor belts. We would presume that there is a preponderance of natural rubber used in transmission belts and in the carcass of conveyor belts. The covers of conveyor belts will use both natural rubber and GR-S. There is every expectation that the use

of neoprene in both friction and carcass will be greatly increased in the near future for underground belts and there will be perhaps some increased use of butyl rubber in certain types of specialty belts. We do not know of any data which might indicate the proportions in which these polymers are being used.

Question: What cements can be used for making splices on cured butyl rubber belts in the field?

Answer: Successful belt splices have been made with cured butyl rubber belts by using butyl rubber cements made of compounds similar to the cover or skim compounds plus a small amount of a tackifying resin to give sufficient tack.

Question: What system is considered best for producing good adhesion between nitrile rubbers and belting textile for use at high temperature?

Answer: The first consideration in producing a conveyor belt for use in high temperature is the selection of a fabric strength member. Cotton, rayon or glass fabrics are in general use. The common practice is to merely friction cotton fabrics with a nitrile rubber friction with no treatment on the cotton fabric. A better method is to treat the fabric with a heat-resisting nitrile cement. Rayon or glass fabrics may be treated with resorcinol-formaldehyde-nitrile rubber latex and good results can be secured.

Question: Would deproteinized rubber be of use in the molded goods or belting field? Is there any demand for sprayed rubber today?

Answer: We do not know of any commercial use of deproteinized rubber or sprayed rubber in the molded goods or belting fields. However, these fields include such a wide array of articles that it may well be that these rubbers have found some specific purpose for which they are particularly well adapted.

Question: Suggest a composition for a flame-resistant conveyor belt cover, excluding chloroprene rubber, with high tensile strength (3500 psi), elongation of 500% and durometer of 58 to 60.

Answer: We do not know of a composition excluding chloroprene which will give strength of 3500 psi, elongation of 500% and a durometer of 58 to 60.

Rubber Hose

(Answers by J. A. Muller)

Question: What are the causes of excessive swelling of hose compounds as they leave the die and how can they be minimized?

Answer: Causes of excessive swelling leaving die include: (1) Swelling is directly proportional to elasticity and inversely proportional to plasticity; (2) Poor design or poor condition of extruder; (3) Poor dispersion; (4) Incorrect warm-up, and (5) Die design —extended conformation tends to result in closer approach to desired dimensions.

Question: What is the best recommendation for prevention of "sun-checking" (ozone cracking)—static but under stress—of compounds using GR-S, natural rubber, and blends of same; if wax, what percentage? (Service involved precludes use of staining materials).

Answer: For protection against sun-checking under static conditions a combination of two non-staining antioxidants is generally more effective than one, and the use of wax in addition, up to 20 parts for some compounds. Don't overlook the possibility of using an after-treatment, such as Hypalon dip, Blackout, etc.

Question: Is it possible to make a rubber cement by simply adding the ingredients to a mixer instead of first milling them into a compound?

Answer: It is possible to make a cement for some purposes by the addition of ingredients to the solvent in a mixer, but for a cement with good reinforcing properties the micro-dispersion obtained only by milling is necessary. For certain end products black may be added to cement in the form of a slurry.

Question: What polymers give the best performance in hose required to resist heat, oils, etc.?

Answer: Polymers to resist heat, oils, etc., include the following: Heat (Dry)—Polyacrylics, Hypalon and butyl rubber; Heat (Steam)—natural rubber and neoprene; Oils (Room Temperature)—Thiokol and the nitrile rubbers; Oils (Hot)—the nitrile rubbers and/or neoprene; Chemicals—the nitrile rubbers for over-all use while for specific uses neoprene, Thiokol, Hypalon, butyl rubber, etc., may be best.

Question: What is the comparative abrasion resistance to particle impingement (slurry, fly ash, etc.) of pure gum natural, carbon-filled natural, neoprene, nitrile, and other compounds for hose and linings?

Answer: Abrasion resistance to particle impingement, which is dependent upon softness and elasticity, is probably, in descending order, pure gum natural, pure gum neoprene, carbon-filled natural carbon-filled neoprene and, lastly, nitrile rubber.

Question: What are the principal processing difficulties of synthetic rubbers presently used in hose and how are they best overcome?

Answer: These may best be discussed by specific polymers, as follows: *Neoprene*—Must be used within a short time after mixing; has no effective retarder. *GR-S*—Poor building tack, which can be overcome by proper compounding and handling. *Nitrile Rubber*—Poor building tack, which can be overcome by proper compounding and handling; high heat builds up in extrusion stocks, which can be controlled by use of retarders. *Thiokol*—Poor building tack and low physical strength in the uncured state appear to be inherent and we know of no way to overcome these difficulties.

Question: Is there any correlation between Mooney viscosities and extruding properties of hose compounds?

Answer: There is correlation to a degree, but it is usually lost to a higher degree as the result of other variables, such as processing aids, etc.

Question: What are the merits of rayon, nylon, Dacron, etc., in mechanical rubber goods? What are their shortcomings or handicaps?

Answer: Generally, the advantage of synthetic fibers is the extension of the users' capabilities to meet requirements not hitherto possible, such as the

superior strength of all three listed being an advantage where dimensions are limited. In rayon, high elongation without increase in permanent elongation which leads to higher efficiency between plies and better utilization of strength. In nylon, impact and shock load absorbing qualities and chemical resistance. In Dacron, dimensional stability. Disadvantages include poor adhesion of all three without proper treatment; loss of tensile strength of rayon upon increase of moisture; high elongation of nylon and its lack of dimensional stability (e.g., shrinkage in yarns and nylon-filled cotton fabric) where exposed to heat.

Cellular Rubber

(Answers by G. R. Sprague)

Question: What type of antioxidant is recommended for use in foam rubber sponge?

Answer: For best antioxidant protection, one like AgeRite White is best. However, it pinks, and customarily the non-staining antioxidants, such as AgeRite Spar, Wingstay S, Santowhite and the Calco's, are used. It is still a matter of cost and non-discoloration.

Question: What is the best method of controlling the dimensional stability of closed cell sponge cured by the two-stage process?

Answer: Control of dimensional stability is one of the most difficult problems in making satisfactory closed cell sponge. There are many theories, and control in every stage of manufacture is necessary. For those people who enjoy a Rubatex license, their Research News Letters go into the problem of dimensional stability control quite thoroughly.

Question: In two-stage curing of cellular slabs, what accelerators would you recommend to obtain the least residual shrinkage? In this type of cure, what effect if any, does the urea activator (Aktone, in particular) have upon residual shrinkage?

Answer: I can only recommend accelerators that give a broad range of cure. Too fast a cure or too slow a cure is poor, and even then residual shrinkage is based on many other factors than acceleration. Urea activators help shrinkage only in their effect on totally decomposing the blowing agent used.

Question: Can rubber-to-fabric and rubber-to-rubber adhesion be improved by compounding the rubber stock to include insoluble sulfur to eliminate sulfur bloom?

Answer: This problem was discussed by the panelists and it was generally agreed that an improvement results in this case when insoluble sulfur is included, provided the end stock can be utilized in a relatively short period of time. Since most such stocks are stored for periods of longer than one week before actual use in the end product, it is doubtful whether the use of insoluble sulfur can be effectively used to eliminate sulfur bloom in this instance.

Question: Have there been any commercial foam compounds based upon reclaimed rubber dispersions or having such dispersions as extenders?

Answer: No—only experimental and not too satisfactory. There is not much percentage in using such dispersions as they have a low solid content, and tensile strength is worse than cold GR-S latex. Modulus is also low and white dispersions are expensive. It is economically sounder to use GR-S latices.

Question: Please discuss the requirements for elastomeric sponge to operate at high temperature—300°F. and above. Are there many applications in this range of operating temperatures? Does silicone sponge meet the requirements?

Answer: Where only high temperature requirements, 300°F. and above, are to be met, both silicone sponge or polyacrylate sponge will do. However, polyacrylates will be serviceable to only 350°F. in continuous use and to 450°F. in intermittent use. Silicone sponge can operate continuously at 450°F. and intermittently up to 550°F. Applications in this high temperature range are growing in the aircraft industry and other industries where performance rather than cost is predominant.

Question: Are there any methods for determining the ratio of closed cells to open cells in a blown sponge?

Answer: There are no accepted methods of determining the percentage of open and closed cells in cellular rubber. The ASTM vacuum water absorption test is used to distinguish between closed cell material and open cell. Material with under 5% weight gain is considered closed cell while open cell will give results of 50 to 100 or more percent. However, DuPont has developed a method with which they have had some success. This method, under a release of January 31, 1955, titled "Measurement of Open and Closed Cells of Isocyanate Foams," uses the difference in pressure in a closed system when empty and when filled with cellular rubber to figure the percentage of closed cells. The mathematics used is not difficult and is explained in the bulletin.

It should be theoretically possible to determine the percentage of closed cells from the ASTM water absorption test. The sample is immersed in water under vacuum and the volume of water absorbed determined. The volume of rubber can be found from the weight and the specific gravity of the compound, and by subtracting the actual rubber volume from the apparent volume, the volume of the cells may be determined. Knowing the volume of water replacing air in the cells, the percentage of closed cells may be found.

Question: What proportion do closed cell products bear to the total? What is the rank of importance of the various cellular products produced? What is the apparent future market for the various types of foamed sponge?

Answer: I do not really know the answer to the first part of the question. Each company would have to be canvassed and the sums then totalled. With regard to the second part, I would rank the importance of the cellular products in the following order: Latex Foam, Open Cell Sponge, Polyurethane Foam, Closed Cell Products, Vinyl Foam. I cannot predict the future market for the various types of foamed sponge, but present consumption is approximately as follows: Latex Foam—220,000,000 pounds per year; Urethane Foam—8,000,000 pounds; Chemical Sponge—60,000,000 pounds.

Machinery and Equipment

(Answers by E. H. Johnson)

Question: What is the current thinking on the relationship of speed, batch size and ram pressure in high speed Banbury mixing?

Answer: The limit of high pressure mixing has yet to be reached, as optimum speed is dependent upon pressure, and vice versa. Stock viscosity also affects optimum pressure and speeds. Increase in speed alone above a certain point, which is governed by stock viscosity, does no good, as apparently voids behind the wing tips become too large and the batch turns as a mass without proper interflow action. As might be expected, the softer stocks react more favorably to speed increases. Increase in pressure only, reaches an optimum dependent upon stock stiffness also. Stiff stocks flow less readily and so require added pressure to get proper interflow and void size reduction.

Recently, very high speed tests, when accompanied by high pressure, have shown startling reduction in batch time with as good or better dispersion. More tests along these lines are indicated and are limited only by the design of the machine. Horsepower ratings as high as 1465 have been reached on our laboratory No. 3D Banbury at 100 rpm rotor speeds, with excellent quality and time gains. The economic evaluation of such an operation in the field has yet to be done.

Question: Are any radical improvements or changes in internal mixers planned for the future?

Answer: No radical improvements are currently planned for the immediate future. The past few years have seen the following:

1. The drop door discharge was designed and installed and is currently used on only the No. 3D and No. 9D Banbury mixers. This design can be and, without doubt, will be used on No. 11's in the near future.
2. High pressure mixing has brought about necessary engineering changes to make this technique a practical operation.
3. Roller bearings have now been furnished for the rotors.
4. Very substantial gains have been made on hard surfacing materials. This is a continuing project and improved technique and knowledge is incorporated into Banbury design as rapidly as proven.
5. The No. 9 Banbury was completely redesigned as a No. 9D machine which incorporated new rotor proportions to get stiffer results. Roller bearings are used to support the rotors. The new design drop door and, of course, the uni-drive are also included. The No. 9D machine can now take the added horsepower required for high pressure mixing which the old No. 9 could not without serious maintenance problems. The No. 9D machine handles a batch midway between the No. 3A and the No. 11.

Question: Can three-roll rubber or vinyl film calenders be used satisfactorily for plying different colored, light gauge (.005 to .015 inch) unsupported stock?

Answer: Three-roll calenders have been used for many years for making two-ply stock in the range specified. However, at best the operation is a compromise and quite tricky. Two banks of stock, of course, are necessary, and the sheets are directed to meet outside of the calender where the lamination is done by a separate pair of rolls. Another method is to direct the sheet from the top pass to the surface of the bottom roll where it is laminated to the bottom roll pass sheet by a cloth pressure roll.

The standard three-roll calender is equipped with even and friction connecting gears. Even speed gears should be used for the above operation so as to direct the sheets to follow the top and bottom rolls by temperature control. A leading friction at the top and bottom rolls would be a decided assist in directing the sheet in the proper direction.

The operation is tricky because the pressures at the top and bottom banks are equal in magnitude if the gauges are the same and the middle roll may float up or down which, of course, affects the gauge. This float is caused by a change in pressure due to a change in the size of either gum bank. The .005-inch sheet may require approximately two and one-half times the pressure for calendering the .015-inch sheet and, therefore, the resulting gauges will not be correct for either extreme. The calender must be tuned for the operation.

Without question, the four-roll calender is the answer to this problem.

Question: Have there been any recent developments in force feed (roll) type extrusion equipment, particularly as regards the extrusion of butyl rubber wire insulation? What does the future hold for these extruders?

Answer: I assume this question relates to the roller feed type of extruder. The Farrel Foundry & Machine Company started building the roller feed tuber, designed according to the Fraser patent which, by the way, is a British patent, in 1925. The roller feed device became a standard part of the design of all extruders built by Farrel for many years. The smaller sizes, including the 3¼-inch and 4½-inch machines were finally dropped because the tuber equipped with the roller feed device could not compete price-wise with the standard type machine. I, therefore, regret that I cannot comment on the recent developments or what future there might be for the small machines used for wire insulation. However, the roller feed device is a decided advantage to the operation of any extruder for homogeneous compounds and may again find a place in the design of the small extruder of the future.

Question: How extensively and in what areas is rubber compound being processed satisfactorily in pellet form?

Answer: There are approximately 50 pelletizers of various sizes from 7 to 20 inches now in use. The majority of these are in the tire plants where there are large volumes of material to be handled and good advantage can be taken of the quick cooling, automatic handling, automatic weighing, and minimum amount of material in process.

Pelletizers are in use in the mechanical goods field, as automat stocks and industrial tires are being handled in pellet form. Reclaimed rubber is being pelletized and shipped in bulk pellet form. Automotive bushing stock is being pelletized prior to injection

molding. And at one plant wire coating stock is pelletized and fed through hoppers to wire coating units.

With the latest designs, where the head can be easily opened, there is more opportunity for pelletizers in handling accelerated and colored stocks.

Question: What is the best method for trimming small irregular parts molded of silicone rubber? At what stage of cure on parts requiring an after-cure may this best be done?

Answer: This question is completely out of my field, but after checking with some of my good friends in the machinery and rubber industries, we have the following to offer: The trimming of the small parts molded of silicone rubber is done before the final cure because of variations in shrinkage. After trimming, the parts are put into the electric oven for the final cure. Another reason for pre-trimming before final curing is that the scrap can be salvaged and worked away without detriment to the material and, of course, with a saving in costs.

Reinforcement

(Answers by B. B. Boonstra)

Question: Can you suggest a composition for a 50 durometer butyl rubber compound with good flex life and high rebound using FEF black?

Answer: Flex life of butyl rubber compounds is inherently very good, rebound is inherently poor, and a hardness of about 50 using FEF black would be obtained by using a loading of around 35 parts of black and 6 parts of oil. Acceleration: 0.4 Polyac with the black, 0.3 Altax and 0.5 Tuads. It may be of interest to try some of the procedures that have been published recently under the name of heat-treatment, which treatment results in softer stocks with higher dynamic resilience. From the panel comes the suggestion of incorporation of 10 to 20 parts phr of Hypalon and, as a second possibility, the addition of brominated butyl rubber in combination with some other polymer.

Question: Where abrasion resistance of belting compounds is important do furnace blacks give better performance than channel blacks?

Answer: This question could be answered better by our belt expert. From the carbon black technical point of view, we find that at the same loading of black phr the furnace blacks of the HAF-SAF series will give better abrasion resistance than channel blacks. Their higher modulus may be a drawback, which can be compensated for by using lower loadings. In the case of the ISAF- and SAF-type blacks, the abrasion resistance at a loading that will give about the same hardness as the channel black compound may still have an advantage as far as abrasion resistance is concerned.

Question: Emphasis has been placed by the automotive industry on new elastomers capable of withstanding high temperatures, of being resistant to oils and other fluids, and which do not contain carbon black loading. What advances have been made in this respect?

Answer: Polymers with elastic properties that are resistant to oils and similar fluids at higher temperatures that have been known for some years are Hycar PA-21 (formerly known as Lactoprene EV), a copolymer of ethylacrylate and chloroethyl vinyl ether, and the Acrylons, copolymers of ethylacrylate or butyl acrylate and acrylonitrile. More recently, fluorinated polymers have become known, such as Kel-F Elastomer, a copolymer of trifluorochloroethylene and a partially fluorinate butadiene, and Poly FBA, fluorinated butyl acrylate. Still more recently, DuPont has come out with a copolymer of vinylidene fluoride and hexafluoropropylene. For applications at elevated temperatures, such as 300°C., in air or oxygen-containing atmospheres, metal oxide fillers are to be used, since carbon black, particularly the finer particle size reinforcing type, will oxidize slowly at those temperatures, and the developed gases may cause blistering.

Question: What is the best method of building hot tear resistance into neoprene stocks?

Answer: In the opinion of the panelists, the use of channel black or one of the fine silica pigments, or possibly a combination of these two materials, would be of help in building hot tear resistance into neoprene stocks. It has also been suggested that the addition of 10% of natural rubber in the compound would be of some value.

Question: What accelerator or combination of accelerators gives the best resistance to flex-cracking and abrasion of a GR-S belting compounded with (a) channel black and (b) furnace black?

Answer: Again this is more of a belting expert question. In general, the thiazole-type accelerators for channel black compounds and delayed action accelerators of the same type for furnace blacks or maybe the thiocarbamate type in a very modern one. If the same accelerating system were used for channel and furnace black compounds, the latter might be near the borderline of scorching, with resultant poor flex cracking and abrasion resistance.

Question: Is there any type of carbon black that, when used as the sole loading ingredient, has an effect on the adhesion properties of natural and synthetic polymers to steel and/or metals?

Answer: Carbon blacks are practically always used in compounds for metal adhesion. When natural rubber compounds with various blacks are compared at loadings to give equal hardness, say 60 Shore A, we have not found significant differences between the blacks, except the thermal blacks that are somewhat low.

When compared at equal loading, there seems to be a tendency toward higher values with the higher structure blacks. Since adhesion figures are difficult to reproduce, it is sometimes difficult to discern significant differences except by statistical analysis on a large number of figures.

Adhesions fail at the points of highest concentration of stress with tearing. Contractions that lead to high stress concentrations are minimized by the use of structure-forming blacks. The tearing is reduced by incorporating a black that imparts high tear resistance. The most favorable combination depends on the particular application.

Editorials . . .

Delayed Deliveries

ALTHOUGH the current crisis in the Middle East is not expected to seriously affect shipments and deliveries of natural rubber, unless it deteriorates within the next few weeks, it has had some reverberations where the domestic rubber manufacturing industry is concerned. The disturbances in that area have had a surprisingly little effect on the price of natural rubber, since no one would have been surprised if this ever-sensitive commodity moved upwards sharply to higher price levels. The price, of course, has gone up in the past few weeks, but only moderately in view of the over-all situation.

The one major effect of the nationalization of the Suez Canal by Egypt was the rerouting of some rubber shipping around the Cape of Good Hope. Actual figures are not available at this writing as to how much shipping was involved in such rerouting, but obviously it was only moderate. Although shipment of rubber around the Cape instead of through the Canal involves some extra cost it is almost evenly balanced by the higher insurance rates which went into effect on Canal shipping after Egypt's nationalization move. At the moment events in Egypt are at fever pitch, and anything can happen.

In the light of the difficulties concerning the Suez Canal in particular and the Middle East in general, the domestic rubber manufacturing industry recently submitted a plan to the General Services Administration under which more rubber would be made available for civilian consumption by delaying deliveries to the natural rubber stockpile. Specifically, the plan calls for GSA to increase its sale of stockpiled rubber and postpone acceptance of rubber to replace it. Under the present rotational program, GSA sells "old" rubber and purchases "new" rubber simultaneously, but gives the seller 60 days for delivery. Under the proposed plan, this same buying-selling arrangement would be continued, but the seller would be allowed up to 120 days to make deliveries. This extended delivery period would help to ease market pressure stirred up by any delay in moving rubber cargoes around the Cape of Good Hope.

In recent months the General Services Administration has rotated approximately 7500 long tons per month, an arbitrary figure. There is no ceiling in the law with regard to rotation amounts and the present figure could be doubled to 15,000 tons a month or more. Actually, the present figure of 7500 tons a month was established by industry demand, and if, by agreement, this demand was increased no particular difficulties would be encountered by GSA if it adopted the proposed increase in replacement time. It is conceivable, however, that in the light of fast moving military actions in the Middle East, to say nothing of events in the Russian satellite nations, our military advisers would oppose even a temporary unbalance in the rubber stockpile. Remember, once bitten, twice shy.

Although the amount of tonnage in the rubber stockpile has never been officially divulged, it is generally conceded to be somewhere in the neighborhood of 1,200,000 long tons. The only official statement on the stockpile is that the goal set by the military authorities was reached some two years ago. GSA has continued to rotate the inventory, however, for two major reasons: (1) It must upgrade non-specification rubber, and (2) It must move any rubber showing signs of deterioration. The so-called non-specification rubber, believed to be about 100,000 long tons, consists of No. 4 and 5 Ribbed Smoked Sheets, thick and thin pale crepe and pale crepe cuttings, and browns and ambers. These were largely acquired some time ago when purchases of specification rubbers (1X, 1, 2 and 3 RSS, 1X thick and thin pale crepe, and select and regular Liberian A) would have caused an artificial price increase.

According to official word, the present 7500 long tons of natural rubber rotated monthly consists of approximately 4000 tons of non-specification rubber and 3500 tons of specification rubber which is beginning to show signs of deterioration. With approximately 100,000 long tons of non-specification rubber still in the stockpile, and with 4000 tons being moved monthly, it will take another two years before the upgrading program will be completed. Such completion is naturally predicated on the assumption that there will be no additional necessity to purchase new quantities of non-specification rubber within the next two years, an assumption which should be re-evaluated in the light of current international affairs.

The change in rotational movements, particularly on delayed deliveries to GSA, was submitted by the 9-man manufacturing segment of the 18-man Rubber Industry Advisory Group, the other 9-man segment representing importers. According to informed sources, GSA has decided to veto the proposal on the grounds that it is not necessary in the light of current conditions. We are not alarmists, but we believe these "current conditions" have reached a stage, or may shortly reach a stage, where action is necessary. It is our guess that shippers will devote more and more shipments around the tip of South Africa in coming months and continue such shipments until a strong and final solution is reached on the operation of the Suez Canal.

Highlights Sidelights *of the News . . .*

November, 1956

The National Science Foundation has made public a report which outlines progress made in following recommendations set forth by its Special Commission for Rubber Research . . . The report indicates that NSF has already approved grants totaling $687,000 for basic research in high polymers . . . Eleven grants totaling $537,000 were made to support scientists formerly engaged in the rubber research program . . . Six grants totaling $150,000 will be made for research in high polymers to scientists other than those formerly engaged in rubber research (page 295).

Publicker Industries has formally notified the Federal Facilities Corporation that it is shutting down production at the alcohol-butadiene facility in Louisville, Ky., which it operates under lease from the government . . . It is reported that Publicker is stepping out of the alcohol-butadiene business because of decreasing demand for the material . . . FFC is currently trying to negotiate a new lease with other companies (page 296).

The Federal Trade Commission has postponed its hearings on restraint-of-trade charges against Goodrich and the Texas Co. so that similar hearings against Goodyear and the Atlantic Refining Co. could begin . . . These cases, as well as another case involving Firestone and the Shell Oil Co., all involve the payment of "over-riding commissions" by the rubber companies to the oil companies in the sales of tires, batteries and accessories through stations handling the oil company products (page 299).

The Government has decided to shelve a rubber industry plan designed to make more rubber available for civilian consumption . . . Specifically, the manufacturers asked the General Services Administration to accept delayed deliveries on natural rubber for the stockpile . . . In practice, GSA would increase its sale of stockpiled rubber and postpone acceptance of rubber to replace it . . . The industry plan would have allowed the seller 120 days to make deliveries to the stockpile rather than the present 60 (page 296).

News of note came this month from C. C. Davis, well-known industry figure, who announced his retirement as chief chemist from the Boston Woven Hose & Rubber Co. (page 301) . . . Henry Nicholas Ridley, the "father of the rubber industry" died on October 24 in London at the age of 100 (page 334) . . . Poncet Davis, president of Robbins Tire, who has been convicted of evading income taxes, has paid a fine of $40,000 . . . Another appeal is scheduled in this case with the plea that Mr. Davis was sentenced under a felony statute when he should have been sentenced under a statute which is considered a misdemeanor (page 308) . . . George Holbrook has been named general manager of the new Elastomer Chemicals Department of DuPont (page 297).

NEWS REPORTS and Industry Activities

NSF REPORTS ON RUBBER RESEARCH ACTIVITIES; GSA SHELVES INDUSTRY STOCKPILE PROPOSALS

ALAN T. WATERMAN, director of the National Science Foundation, Washington, D. C., has made public a report made by that organization to its Special Commission for Rubber Research which outlines the progress made by NSF in following recommendations set forth by the Commission. The Special Commission for Rubber Research, in essence, made the following recommendations: (1) The Foundation's program of rubber research should be terminated as of June 30, 1956; (2) The Foundation should initiate a program of support to basic research in the field of high polymers; (3) The Executive Branch of the Government should give careful consideration to the actions needed to insure an adequate production base for "natural synthetic rubber" in the event of an emergency, and (4) The Government Laboratories at Akron should be offered for sale with disposal being deferred for one year in case the University of Akron should be willing to accept a one-year lease of the facility at no cost to the Government. Mr. Waterman stated that the Federal Government has carried out the foregoing recommendations in the following way:

(1) The "rubber research program" of the Foundation, which had been taken over a year earlier from the Federal Facilities Corp., has been terminated. Rubber research contracts were closed out June 30, 1956. The NSF Rubber Research Group, which was the organizational unit responsible for administering the rubber research program, ceased to exist as of July 1 and its records transferred to the Chemistry Program of the Foundation.

Seventeen Grants Approved

(2) The Foundation has already approved seventeen grants in the amount of $687,000 for basic research in high polymers. All of these grants, except one, are for periods longer than one year. Eleven grants totaling $537,000 were made to support scientists formerly engaged in the rubber research program. No grant was made to a private research firm (whose proposal was adjudged to be of an essentially applied research character), and a small, one-year grant was made to the Bureau of Standards as a transitional measure.

As a part of its regular program, the Bureau will secure its own appropriations for high polymer research for the fiscal year 1958. Included in the sum mentioned above, the Foundation has made or will make six grants approximating $150,000 for research in high polymers to support scientists other than those formerly engaged in the rubber research program. To fund all of these grants, the Foundation plans to use $500,000 of carry-over funds from the rubber program, with the remainder of the funds coming from the regular appropriations of the Foundation. In fiscal year 1958, high polymer research will be financed mainly out of regular funds available to the Chemistry Program of the Foundation.

(3) The Office of Defense Mobilization and the Department of Defense will continue to give serious attention to the production base of synthetic natural rubber. The Department of Defense has placed orders for limited quantities of tires made from the new rubber. In his message to Congress dated April 30, 1956, and dealing with rubber requirements and resources, the President said in part: "The Government has available a number of means for assisting industrial development and expansion where such aid is found to be essential to national security. It is not now expected that any unique measures, such as would require new legislation, will need to be taken with reference to the development of capacity to produce synthetic natural rubber."

In the above connection, only one of the three companies having publicly announced the synthesis of the new polyisoprene polymer applied for a certificate of necessity allowing accelerated tax amortization to cover the construction of development or production facilities for the new process. In this case the certificate was granted promptly. It is to be observed that the Federal agencies concerned have their eye on this problem and that continuing encouragement will be given to private industry to further this new technological development.

(4) On February 10, 1956, the Foundation offered to the University of Akron a one-year lease of the Government Laboratories under terms recommended by the Special Commission. On February 16, 1956, the University of Akron rejected this offer. Consequently, the Foundation recommended legislation to the Congress which would authorize the disposal of the Laboratories by the General Services Administration—first, by sale to the public, and in default of such a sale, by other appropriate disposal. This legislation was enacted by the Congress and the President has just signed into law the following:

"Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, that the Government Laboratories at Akron, Ohio, now under control of the National Science Foundation, are hereby transferred to the General Services Administration for disposal in accordance with the Federal Property and Administrative Services Act of 1949, except that the Administrator of General Services shall first offer the laboratories for public sale before seeking to dispose of them by transfer or assignment to any Federal agency.

Value to Federal Agencies

"The GSA Administrator, before he offers the laboratories to the public for sale, shall ascertain what the value of the laboratories would be to Government agencies which would make substantial use thereof, and the Administrator shall not sell the laboratories to the public unless he finds, after consultation with the Director of the Budget Bureau, that such sale to the public would be in the best interests of the United States, taking into consideration among other relevant factors the value of the laboratories to any interested agency and the amounts offered by public bidders. The National Science Foundation is authorized to reimburse the General Services Administration in advance for expenses necessary for the protection and maintenance of the laboratories up to June 30, 1957."

Mr. Waterman concluded his report by saying: "I believe that the Executive

Branch of the Government and the Congress have together taken action designed to carry out completely the letter and the spirit of the recommendations of the Special Commission for Rubber Research. I am sure that I speak for all in the Government who are concerned with rubber and rubber research when I express again our sincere appreciation for the outstanding public service rendered by the members of the Commission."

Rejects Stockpile Plan

Reports from Washington state that the Government has decided to shelve a rubber industry plan designed to make more rubber available for civilian consumption. Spokesmen for the General Services Administration said a plan to delay deliveries to the rubber stockpile—in the event of a Middle East crisis—was presented to them in September by rubber manufacturers. GSA, however, was to have notified the industry that the program is not necessary in the light of current conditions.

Specifically, the manufacturers asked GSA to accept delayed deliveries on natural rubber purchased from commercial sources. It would have worked this way: GSA would increase its sale of stockpiled rubber and postpone acceptance of rubber to replace it. In rotating stockpiled rubber, GSA sells old rubber and purchases new simultaneously, but gives the seller 60 days to deliver. Under the industry plan, the seller would have been allowed up to 120 days to make deliveries. The extended delivery period would have helped to ease market pressure stirred up by delays encountered in moving rubber cargoes around the tip of South Africa.

With traffic from the Far East rubber ports moving through the Suez Canal at a normal rate, GSA decided the program was not feasible at this time. The decision will leave GSA on the same stockpiling schedule it has maintained for months—rotation of 7,500 tons monthly.

The stockpile goal, reportedly 1,200,000 long tons, was met two years ago, but GSA has continued to rotate the inventory for two reasons: (1) It must upgrade "non-specification" rubber it purchased some time ago when specification purchases would have caused an artificial price boost and (2) It must move out rubber showing signs of deterioration.

Non-Specification Rubber

For the next two years, GSA will continue to rotate 4,000 tons of "non-specification" rubber and 3,500 tons that are getting old. George Casto, director of the Agriculture Division of GSA's Defense Materials Service, said the upgrading program should be completed within 24 months, when this part of the program will be dropped.

In the meantime, he and Defense Materials Commissioner E. H. Weaver have scheduled another meeting in January with the group responsible for the emergency rotation plan just turned down—the 18-man Rubber Industry Advisory Group. The group is made up of nine members representing each segment of the industry—manufacturing and importing. It was the manufacturing team which came up with the rotation recommendation.

An industry spokesman said the plan was proposed as a "precaution" because of the Suez controversy. With the increased transit time of rubber-carrying ships forced to go around the Cape of Good Hope, he said, some delay in deliveries to the U. S. was inevitable. GSA, he said was "one place where there is plenty of materials," with about 180,000 tons of specification and non-specification rubber available.

"We recommended an increase in the replacement time if something serious happened," he said. The amount exempt from normal 60-day delivery, he explained, would depend upon shipping delays encountered by an emergency. He said there was no ceiling in the law on how much deterioration rubber GSA could rotate, and that the agency was free to rotate another 7,500 tons per month for the upgrading program.

"The only reason GSA is moving (only) 7,500 tons per month (now)," he said, "is because that is all the industry is ordering. If something happened to the imports in the way of a temporary delay, then the slack would be taken up by GSA's increasing the replacement time temporarily (on new deliveries to the stockpile)."

Closing Down Production

Publicker Industries, Inc., Philadelphia, Penna., present operator of the government-owned alcohol-butadiene facility at Louisville, Ky., has formally notified the Federal Facilities Corporation that it is shutting down production. The immediate effect of the move, which is permitted under terms of the lease, is to shift the cost of maintenance of the plant from the company to the government.

It is reported that Publicker is stepping out of the alcohol-butadiene business because of lessened demand for the material. The plant originally filled a gap between over-all butadiene demand and the supply of the petroleum-derived type. Now, there is enough petroleum butadiene available, particularly since sales to the synthetic rubber plants haven't maintained earlier anticipated levels.

Meanwhile, FFC is trying to negotiate a new lease with other companies for the facility. Proposals to lease the plant were received by the government agency up to October 31, 1956. For a period of not less than thirty days from October 31, FFC will negotiate with those submitting proposals. The date of termination of such negotiations will be determined by FFC and announced to all eligible bidders.

Technical Personnel Wanted

The Naval Air Material Center, Philadelphia 12, Penna., has an urgent need for qualified Electronic Scientists, Metallurgists, Physicists, Technologists, and Engineers (Aeronautical, Electrical, Electronic, Industrial, General, Mechanical and Power Plant). The Center is currently engaged in an extensive program of aeronautical research, development, experimentation and test operations for the advancement of Naval aviation. Starting salaries range from $4480 to $7570 per annum. Application for Federal Employment, Standard Form 57, should be filed with the Industrial Relations Department, Naval Air Material Center, Naval Base, Philadelphia 12, Penna. Applications may be obtained from the above address or information as to where they are available may be obtained from any first or second class post office.

Penn-Texas To Buy Lowell

Negotiations for the acquisition of the Lowell Insulated Wire Co., Lowell, Mass., by the Penn-Texas Corp., are nearing completion pending approval of directors of both companies. Purchase of the Lowell concern will be through an exchange of stock which will include land, buildings, mechanical equipment and inventory. Details on how much stock is involved are not available. The Lowell Insulated Wire Co. is a division of the Overlakes Corp., Lowell, Mass., makers of insulated wire for independent telephone companies, cable for the Signal Corps and power supply cords for appliance manufacturers. Purpose of the acquisition is to extend the present line of the Crescent Co. of Pawtucket, R. I., a Penn-Texas subsidiary, which produces insulated wire and cable for the automobile, electronic, radio, electrical and welding industries. Lowell Insulated Wire will be under the supervision of Crescent's president, John M. Sapinsley.

English Synthetic Unit Planned

Blaw-Knox Co., Pittsburgh, Penna., has announced that it is designing and constructing a $10,000,000 synthetic rubber plant for the International Synthetic Rubber Co., Ltd., near Fawley, England, a newly formed company organized by Dunlop Rubber Co., Ltd., the Goodyear Tire and Rubber Co. (Great Britain), Ltd., the Firestone Tire and Rubber Co. and the Michelin Tire Co., Ltd. The first synthetic rubber plant to be built in Great Britain, the new facility will have a capacity of 50,000 long tons of GR-S type rubber a year. It will be located adjacent to the petroleum refinery of Esso Petroleum Co., Ltd., which will supply butadiene to the new unit. The project will include the plant and administration, laboratory, machine shop, warehousing and shipping buildings.

Catalin Plans Research Unit

Catalin Corp. of America, New York, N. Y., has announced plans to construct a new laboratory for the development of special chemicals at the Fords, New Jersey plant. The unit will cost upward of $500,000 and an initial outlay of $100,000 has already been approved by the board of directors. Recently, Catalin began production of antioxidants and oil additives. The new plant will enable the company to undertake research for further diversification.

DUPONT ANNOUNCES FORMATION OF ELASTOMER CHEMICALS UNIT

E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., has announced the creation of a new department, Elastomer Chemicals, to be responsible for research, production and sales for all products currently handled by the Elastomers Division of the company's Organic Chemicals Department. The new organization, bringing the total of the company's operating departments to 11, will have as its general manager Dr. George E. Holbrook, assistant general manager of the Organic Chemicals Department. Samuel G. Baker, recently appointed general manager of the Organic Chemicals Department, will continue as head of that department.

The step, which becomes effective January 1, was taken because the expanding business and product lines of the Elastomers Division now justifies the organization of a separate department. In addition to neoprene and rubber chemicals, the new department will manufacture and market "Hypalon" synthetic rubber and "Hylene" organic isocyanates.

Dr. Holbrook, a native of St. Louis, Mo., first went to work for DuPont following completion of his graduate studies at the University of Michigan in 1933, beginning as a research chemist at the company's Jackson Laboratory, Deepwater Point, N.J. In 1949, he was transferred to Wilmington where he was named successively assistant director of the Organic Chemicals Department's Technical Division, departmental engineer, and manager of the plants development section. He was then transferred to the Development Department and appointed assistant director in 1951.

Held Government Posts

Dr. Holbrook, given leave from the company on April 1, 1952, became deputy director, Chemical Division, Chemical, Rubber and Forest Products Bureau of the National Production Authority, subsequently advancing to director. He returned to DuPont and resumed his duties as assistant director of the Development Department in November, 1952. In May, 1955, he was named assistant general manager of the company's Organic Chemicals Department.

DuPont has also announced the appointment of two assistant general managers, Dr. William C. Kay for the Organic Chemicals Department and Ernest R. Bridgwater for the newly created Elastomer Chemicals Department. Dr. Kay, director of manufacture of the Organic Chemicals Department, succeeds Dr. George E. Holbrook. Mr. Bridgwater has headed up sales activities of the Rubber Chemicals Division, later the Elastomers Division, since 1929.

Dr. Kay, a native of Melrose, Minn., was graduated from the University of Minnesota in 1930. Upon obtaining his doctor's degree in science from Massachusetts Institute of Technology, he joined DuPont's Engineering Department in 1934 as an industrial engineer at the company's Chambers Works, Deepwater Point, N.J. In 1939, he was promoted to project engineer and between 1941 and 1943 he was chief supervisor of the production of neoprene.

During DuPont's participation in the Manhattan Project in World War II, Dr. Kay was transferred in 1943 to the Clinton Laboratories at Oak Ridge, Tenn., as production superintendent. In 1944, he was moved to Richland, Wash., as a department superintendent and later technical superintendent at the Hanford Engineer Works, the plutonium plant which DuPont designed, built, and operated for the government. In 1947, he was named process manager of the company's Grasselli Chemicals Department and in the latter part of 1950 was appointed director of manufacture, Atomic Energy Division, in the Explosives Department. Following a brief period as technical director of the Atomic Energy Division, he was named director of manufacture of the Organic Chemicals Department in April, 1955.

Mr. Bridgwater joined DuPont as a rubber chemist in 1924 and in 1929 was made sales manager of the Rubber Chemicals Division, later the Elastomers Division. Two years later, he was appointed division manager. In 1949, following the consolidation of division manufacturing activities into a separate manufacturing division for the Organic Chemicals Department, Mr. Bridgwater was named to his present position, director of sales for the Elastomers Division.

Mr. Bridgwater, born in Akron, Ohio, studied at the University of Akron and was graduated from M.I.T. with a degree of bachelor of science in 1918. Following his discharge from the chemical warfare service at the end of World War I, he was employed as a rubber chemist by the B. F. Goodrich Co. for three years and by the Firestone Tire and Rubber Co. for two years prior to joining DuPont in 1924.

G. E. Holbrook

E. R. Bridgwater

W. C. Kay

Cornmesser Named Manager

The appointment of Donald E. Cornmesser as manager of manufacturing of the Bridgeport, Conn., plant of the H. O. Canfield Co., Inc., has been announced. Mr. Cornmesser was associated with the Goodyear Rubber Co. for more than 8 years. He is a former employee of the U. S. Treasury Department and before joining H. O. Canfield, he was director of engineering for the Vulcanized Rubber and Plastics Co. in Morrisville, Penna.

Firestone Promotes Crandall

Clarence L. Crandall has been promoted to production manager of Plant 1 of the Firestone Tire and Rubber Co., at Akron, Ohio, succeeding M. L. Becker, who will retire soon. Mr. Crandall graduated from Michigan State University in 1936 with a bachelor of science degree in chemical engineering and in 1937, he received a master of science degree at the same school. He joined the Firestone College Training Class in 1937, spending six months as an engineer in the Power House in Akron. From there he went into the General Laboratory and served as a processing control and compounding engineer for five years. From 1942 to 1948, he was in charge of the Technical Department of the Buenos Aires, Argentina, plant and in 1948 to 1950 was production manager of the Port Elizabeth, South Africa, plant. Mr. Crandall returned to Akron at the end of 1950 and worked in the Tire Production Division on special assignments in connection with tubeless tires for two years. Since 1953, he has been division manager of Materials Preparation Departments at Akron Plant 1.

Grace Acquires Hyrad Process

W. R. Grace and Co., Philadelphia, Penna., has announced that it has acquired both United States and world rights to the "Hyrad" process, which utilizes irradiation to modify and improve polyethylene and other polymers, from the Sequoia Process Corp., Redwood City, Calif. According to the company, acquisition of this new process implements the program now underway with the building of an $18,000,000 plant in Baton Rouge, La., for the manufacture of a new high-density polyethylene licensed by the Phillips Petroleum Co. Grace's Polymer Chemicals Division will supply polyethylene compounds and technical service know-how so that fabricators can use the process in manufacturing their own line of products. The irradiation process greatly improves polyethylene giving the material remarkable resistance to heat, reducing cold flow and stress cracking and increasing tensile strength, the company says.

General Tire & Rubber Co., Akron, Ohio, has placed the first order for the executive version of the Fairchild F-27, a twin-propjet, pressurized transport with a cruising speed in excess of 280 miles an hour.

NRDB HOLDS INTERESTING LONDON CONFERENCE ON RUBBER IN ENGINEERING

On September 27, the Natural Rubber Development Board of London, England, held an interesting one-day conference on "Rubber in Engineering." The conference was held in the Lecture Hall of the Institution of Electrical Engineers in London and featured not only the presentation of several papers, but a display of engineering uses of rubber staged by leading manufacturers in the field.

The meeting got underway at 10:00 A.M. with an official opening. This was followed by the presentation of the first paper, "Rubber Must Be Used Correctly" by W. J. S. Naunton. The author stated that there is not another material used by the engineer which has the wide utility and range of physical properties of rubber. But there is one essential condition to its successful employment and that is that it must be used correctly. It must be correctly compounded, processed and vulcanized for the purpose in hand, it must be correctly designed for the unit in which it will function and it must be used correctly during its life. Failure to realize these three "musts" will result in disappointment and an unjustified prejudice against the use of a most useful engineering auxiliary material.

The next paper presented at the conference was entitled, "Load-Deflection Relations and Surface Strain Distributions for Flat Rubber Pads" by A. N. Gent. Experimental measurements of the load-deflection relations for flat rubber pads in compression were described. These measurements were shown to be fair agreement with a simple empirical relationship for a wide range of thicknesses and for varied shapes of cross section.

Simple measuring techniques were described whereby the distribution of strain over the surface of rubber components may be examined experimentally. These methods have been used to determine the state of strain of the free surfaces of some bonded rubber cylinders subjected to overall compression and extension.

Interesting Film Shown

After a break for light refreshments, the conference continued with the showing of a film on "Rubber in Engineering." This was the first time that this film was ever shown. Following the presentation of the film, luncheon was served and this was followed by the reading of another paper, this one entitled, "The Use of Rubber in Heavy Engineering" by S. W. Marsh. The author observed that the possibilities of rubber as a true engineering material first began to be exploited about twenty years ago. Since then, the great strides made by rubber technologists in the improvement of mixing techniques have greatly enlarged the scope of rubber in many branches of the engineering industries. Even today, rubber is finding new applications as every year passes by.

Mr. Marsh stated that designers are finding that problems which could only be solved by relatively complicated mechanical devices can now be overcome more simply by using this versatile material. The author then provided a general outline of the uses of rubber in heavy engineering, including buildings, and divided his outline into four basic sections: (1) Ships and Jetties; (2) General Engineering (including buildings); (3) Couplings, and (4) Railway Engineering.

Following Mr. Marsh's paper, the meeting broke again for a period of light refreshments. Next on the program was a paper on "Dynamic Fatigue Life of Rubber Components" by P. W. Turner. The author declared that in order to design with confidence rubber components for use in dynamic conditions, such as engine mountings, springs, etc., it is desirable to be able to fix the dimensions and other parameters controlling the endurance and reliability of the component so that it is as small and economical as it is consistent with adequate fatigue life. It is even more important, he said, to be able to estimate the way in which a design change to an existing component will influence its endurance under given operating conditions.

To this end, a program of fatigue testing was undertaken and an attempt made to establish, on an empirical basis, a generalized correlation between the conditions of fatigue and the fatigue life. The number of cycles to fail of many different types of full scale rubber springs was determined by rig testing and, in addition, much systematic data was obtained using torsional shear rubber elements operating over a constant range at frequencies of 800 and 1,600 cpm.

Rubber in Agriculture

The final paper at the conference was entitled "Rubber in Agriculture" by S. J. Wright. The aim of this paper was to give some account of the special uses to which rubber has been put in agriculture up to now, and to suggest to both rubber technologists and agricultural engineers that rubber usage in farming may well be altogether more widespread in the future.

The conference concluded with a second showing of the film, "Rubber in Engineering."

General Adhesives Co. Formed

General Shoe Corp., Nashville, Tenn., has announced the formation of the General Adhesives Co. General Adhesives will be operated as a division of the Chemical Division of the parent company. The new company will be located at 6100 Centennial Boulevard in Nashville, and will take over all of the industrial adhesives business of the S. & F. Chemical Co., Inc. Harold L. Gross, formerly technical director of S. & F., has been appointed vice-president and general manager of General Adhesives. A complete line of rubber, synthetic rubber, reclaim and resin based solvent adhesives and industrial coatings, and all types of latex and resin dispersion-based adhesives and coatings will be manufactured. S. & F. will continue to concentrate on the shoe industry in the South and West, while General Adhesives will concentrate on industrial outlets.

Three New Harshaw Toners

Zinsser & Co., Inc., a subsidiary of the Harshaw Chemical Co., Cleveland, Ohio, is producing three new toners, benzidine Toner Yellow 2222, Crotonfast Green Toner 4D-3600 and Green Y Toner 4D-3350. Toner Yellow 2222 is an acetoacetorthotoluidide type of benzidine yellow and is said to be markedly better than ordinary benzidines against effects of sunlight and alkali media. The new color is opaque, high strength, easy working and non-toxic. It may be used in rubber compounds, alone or in combination with phthalocyanine blues to make permanent greens, and it may also be used for bright and alkali resistant vinyl floor covering. Both green toners are stable chlorinated copper phthalocyanines, and are said to be lightfast, heat resistant and chemically resistant colors. They blend well with yellow pigments to produce a wide range of lighter greens. The green toners may be used in rubber and all plastics because of their ready dispersibility, chemical and heat resistance and resistance to migration, the company stated. They are also said to perform well in flooring compounds.

U. S. Rubber Promotes Fish

W. Richard Fish, formerly assistant treasurer, has been named assistant to the executive vice-president of the U. S. Rubber Co., New York, N. Y. In other company actions, W. H. Kriete and T. V. Horrigan were elected assistant treasurers to fill the vacancies resulting from the death of Alva F. Myers and the promotion of Mr. Fish. The board also appointed Walter Chwals general auditor of the company. Mr. Kriete will be in charge of forecasts, budgets, business and cost analysis and Mr. Horrigan will supervise corporate accounting, sales and branch accounting and methods and tabulation. Mr. Chwals will head the tax and internal audit section. Mr. Fish, new assistant to the executive vice-president, is a graduate of Miami University, Ohio, where he received a B. S. degree in business administration. He has held a number of positions with U. S. Rubber since he joined the company in 1935 as a traveling auditor.

Campco Extruded Sheet

A new modified styrene sheet made for the printing requirements of the display, toy and other industries, called "Registrite", has been introduced by Campco Division, Chicago Molded Products Corp. According to Campco, the new material has a lower and consequently more uniform strain pattern, superior color and lower cost than materials previously used for print register applications. Registrite's strain pattern, Campco claims, approximates a near uniform 5% and, therefore, affords more accuracy of the final image on the vacuum-formed product. Registrite's mat finish is said to be an ideal surface for printing ink adhesion and its especially formulated blue-white color enhances printed colors. Registrite has high impact resistance and excellent formability. This material is stocked in various thin gages desired for display work.

FTC POSTPONES GOODRICH CASE TO BEGIN GOODYEAR HEARINGS

The Federal Trade Commission, which has been holding hearings in Washington, D. C., on restraint of trade complaints against the B. F. Goodrich Co. and the Texas Co. on matters pertaining to the payment of "overriding commissions" by the rubber company to the oil company, has postponed that case until January so that similar hearings involving the Goodyear Tire & Rubber Co. and the Atlantic Refining Co. could commence.

The Goodrich-Texas hearings initially began on September 10 with the marking of documents for identification. Following these preliminary activities, the case got under way on October 15. At issue were the "overriding commissions," those fees paid by rubber firms to oil companies in the sale of tires, batteries and accessories through stations handling the oil company products.

The rubber companies admit paying the commissions, but insist they are for legitimate sales assistance. The oil companies state that they earn the commissions through their sales promotion efforts and deny coercing dealers handling their brand products. It is up to the FTC trial examiner to decide whether the oil companies merely "push" the rubber company products, or whether these products are forced upon gasoline station owners. FTC attorneys charge that the oil companies have such power over their stations, mainly because they can cancel an operator's lease.

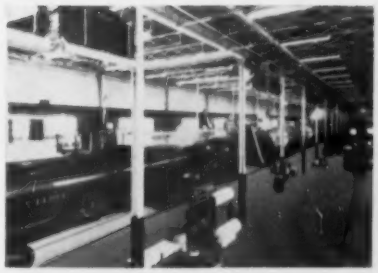
Witnesses at the sessions beginning on October 15 included Texas sales manager S. C. Bartlett and Goodrich vice-president Joseph A. Hoban. Mr. Hoban stated, as had Texaco officials, that the commissions paid the oil company are for sales assistance. The government tried to show that the chief assistance was in getting the dealer to accept the recommended brand. Finally, on October 18, FTC announced that the Goodrich-Texas case would be held over until January 14 with hearings in Chicago, Ill.

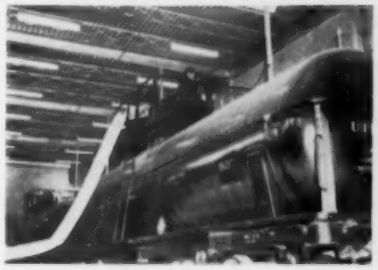
The case involving Goodyear and Atlantic Refining began in Washington on October 29, while a similar case against the Firestone Tire & Rubber Co. and the Shell Oil Co. is to begin on December 10.

A sidelight to the FTC charges involving Firestone came to light during the month when Representative Joe L. Evans (Dem., Tenn.), who heads a subcommittee studying federal regulatory agencies and the effect they have on small business, spoke out against Edward F. Howrey, former FTC chairman, for his handling of cases involving Firestone. Mr. Evans, stating that his remarks against Mr. Howrey represented only his own views, pointed out that Mr. Howrey represented Firestone in FTC cases before becoming chairman of that body. Mr. Howrey's old law firm is representing Firestone, and his new law firm is representing Shell in the case now before the FTC, Mr. Evans declared.

Take a long time for this copy of RUBBER AGE to reach your desk? Use the coupon on page 379.

AUTOMOTIVE RUBBER COMPLETES NEW TANK CAR LINING FACILITY





Automotive Rubber Co., Inc., Detroit, Mich., has completed an addition to its Schoolcraft, Mich., facilities for rubber processing of tank cars. The plant, which is 60 by 240 feet with a working height of 26 feet, is constructed on a production line basis involving parallel railroad spurs, each capable of handling five railroad tank cars. This brings the total number of cars under continuous production to ten units. Mezzanines are built at tank top level with "cat walks" to the dome platforms on the cars. Before application, the rubber lining is prepared on warming and cutting tables next to the dome openings of the tank cars. Cars are moved from station to station by a super-heavy duty floor conveyor and super-bomber hangar type doors at both ends of the building permit the continuous movement of cars. Plans are now in progress for another mass production tank car lining plant as an addition to the company's Houston, Texas, facilities. The photographs above depict various scenes in the tank lining process. *Upper left:* The tank car lining plant with 10-car capacity; *Lower left:* Contributing equipment moves with tank car as it progresses from station to station towards completion; *Upper right:* Work areas are mezzanines swung from ceiling at car dome level; *Lower right:* Workers applying tailored rubber or synthetic sheet to inside of tank car at Automotive Rubber.

Organizes Industrial Division

Wilson Rubber Co., Canton, Ohio, has announced the organization of an Industrial Division as an initial step to revitalize and expand the company's various manufacturing and marketing operations. E. Jack Barns has been named director of sales and T. L. Peterson, sales assistant to the executive vice-president. Mr. Barns attended the University of Illinois and has served Wilson in the rubber glove field for over thirty years in an executive sales capacity. Mr. Peterson, a graduate of Wooster College, was formerly a division sales manager with Becton, Dickinson and Co., Chicago, Ill., of which Wilson became a subsidiary in 1954.

ADM Division Headquarters Moved

Headquarters of the Chemical Products Division of the Archer-Daniels-Midland Co., have been moved from Cleveland, Ohio to Minneapolis, Minn. The purpose of the move was to provide better coordination between the sales, research and development activities of the division and other ADM divisions. Best known for its sperm whaling activities, the division also processes large quantities of fats and oils produced on the nation's farms.

Kuehn Realigns Officers

N. L. Kuehn, founder, former president and general manager of the N. L. Kuehn Co., Milwaukee, Wisc., has been named chairman of the board and will retain his duties as treasurer. Suceeding Mr. Kuehn as president and general manager, is Henry W. Luedtke, who has been associated with the firm for 18 years, most recently as vice-president. Oliver C. Nusslock has been named vice-president in charge of sales. At the annual directors' meeting, Donald N. Kuehn was re-elected vice-president. He will also take on additional duties as secretary and assistant general manager. The realignment was made in connection with the firm's recent move to larger quarters, a 25,000 square foot building at 3747 N. Booth St., Milwaukee, bringing the company's operations under one roof.

Starts Vinyl Resin Production

The new plant of the Insular Chemical Corp., Hicksville, N.Y. has begun production of vinyl resins. Insular Chemical is jointly owned by the Rubber Corp. of America, Hicksville, N.Y. and the Ross and Roberts Division of Pollak Industrial Corp., New York, N.Y.

TALK ON BUTYL COMPOUNDING FEATURES ONTARIO MEETING

The Ontario Rubber Section of the Chemical Institute of Canada held its Fall Meeting on October 9 at the Pickfair Restaurant, Mimico, Ontario, Canada. The dinner was preceded by a cocktail party with the Polymer Corp. of Sarnia, Ont., acting as host. Principal speaker of the evening was E. B. Storey, group leader in the Compounding Section of the Polymer Corp. Mr. Storey spoke on "Developments in Butyl Rubber Compounding."

Mr. Storey noted that recent progress in the use of butyl rubber has centered around the application of heat-enhancement methods for modifying the properties of butyl-filler systems and chemical treatments, such as bromination, that increase the compatibility of butyl rubber with other elastomers. In conjunction with the inherent superiority of butyl in permeability, ozone and aging resistance, these developments were said to have opened the way for a wider utilization of butyl rubber in tire tread and sidewalls.

In discussing the heat-enhancement of butyl rubber-furnace black mixtures, the speaker described laboratory studies to determine the effects of time, temperature, carbon black levels and promoter loadings on the processability and physical properties of butyl compounds. Promotion of an 80 part HAF black compound by one part of GMF could be produced at temperatures of 310 to 320°F. Dilution of the treated masterbatch to a 50 part loading of black was said to provide an optimum balance of processing and vulcanizate properties. The higher black masterbatch actually required a lower power consumption during compounding and the low-strain modulus and hysteresis were reduced to a lower level than was obtained previously by channel black heat-treatments.

Cites Brominating Methods

Methods of brominating butyl rubber were described that involve a simple static heating with commercially available brominating agents. Using tie gums prepared from such chemical derivatives, it was found that adhesions of 50 to 70 pounds per inch could be obtained between Butyl-HAF black compounds and GR-S/natural rubber carcass stocks, provided that the thickness of the tie gum was greater than 50 mils.

The adoption of butyl compounds in the construction of passenger car tires occurred with the introduction of tubeless tires. The superior resistance to permeation by air made such compounds the ideal choice for the air-retaining liner. The next logical development appeared to be in sidewall compounds. Here the resistance of butyl to ozone-cracking could provide a further increase in tire safety. Measurements were given of the air loss in tubeless tires indicating that a large increase occurred when the sidewall became cracked in service. Such losses were found to be equivalent to those resulting from removal of a portion of the sidewall layer, Mr. Storey stated.

Heat enhancement methods were shown to be effective with butyl compounds containing white fillers as well as carbon blacks and, in the case of calcium silicate, the modulus at 25% elongation was reduced by 35%. This resulted in a large improvement in the "snappiness" of the butyl vulcanizate and its performance in dynamic service, the speaker concluded.

Rubber Mats for Cows

Giving dairy cows rubber mats to sleep on provides money-saving advantages as well as comfort for the cows, according to a recent issue of *Farm Journal* magazine. The publication reports that last winter the idea was tested by University of Massachusetts dairymen, who agreed that rubber insulation between the cow and concrete, with or without bedding, provided protection for teats and udders; that cows slipped less getting up or down, and that only half as much bedding was required when rubber mats were used.

X-1516 Conductive Silicone

Silicones Division, Union Carbide and Carbon Corp., New York, N. Y., has announced the commercial availability of "X-1516 Silicone Rubber Compound". Compounded with carbon black, X-1516 is conductive and can be molded, calendered or extruded without appreciably changing its electrical properties. This is in contrast to the organic rubbers, which have to be carefully handled to preserve their conductivity. X-1516 shows superior conformance to extrusion die contours and mold surfaces, so that it can be made into difficult or odd shapes. Because of its conductivity and its resistance to temperatures as high as 400°F., X-1516 can be used to make anti-fogging heater pads on aircraft cameras. X-1516 is also used to provide an electrically conductive shield for silicone insulated electrical equipment. Since X-1516 can be extruded in the form of an electrically conductive tubing or hose, it may be found effective to drain static charges and prevent sparking in hospital operating rooms, or in handling explosive gases or dusts.

Columbian Forms Mexican Branch

Oscar Moreno, V has been named manager of the newly formed Columbian Carbon International de Mexico, S. A., a wholly owned subsidiary representing Columbian Carbon Co., New York, N. Y., in the sale of its carbon blacks, carbon black dispersions and iron oxides in Mexico. The new company will also handle the raw materials and equipment in Mexico, formerly handled by Binney and Smith International. Headquarters for the new company are located at Coahuila 223, Mexico 7, D. F.

SPARKS AND THOMAS SPEAK AT THIOKOL TECHNICAL CLUB

At the Thiokol Technical Club dinner-meeting on September 25, 1956, held at the headquarters of Thiokol Chemical Corp., Trenton, N. J., Dr. W. J. Sparks, director, Chemicals Research Division, Esso Research and Engineering Co., Linden, N. J., and R. M. Thomas, assistant director of that division, addressed an audience of over 200 scientists, chemists, engineers, bankers, and industrial executives actively interested in rubber and allied industries on the subject "Butyl Rubber". The topic was a timely one, since Thiokol, in August of this year, had announced its formation of a butyl rubber sales-service organization to initiate a butyl marketing program.

Dr. S. M. Martin, Jr., Thiokol's vice-president in charge of sales, introduced Mr. Thomas and Dr. Sparks. Mr. Thomas spoke first, covering the actual manufacture of butyl rubber. He illustrated his discussion with slides showing a production flow sheet. He, with Dr. Sparks, was co-inventor of butyl rubber.

Butyl Rubber Potentials

Dr. Sparks, the next to speak, discussed at length the potentials of butyl rubber in various fields—mechanical goods, wire and cable, adhesives, tires—and emphasized the importance of the butyl rubber tire, which has been made successfully by the Esso Chemicals Research Division and is almost certain to be introduced by various manufacturers within the coming year.

Dr. Sparks pointed out some of the advantages of the butyl rubber tire over the regular synthetic rubber tire: a quiet ride on rough roads; no squeal on turns; faster stopping on wet and dry roads; better sun checking resistance; better shock-absorption properties, giving a smoother ride on uneven surfaces; better resistance to radial cracking of the sidewalls. A professional film on rubber tires illustrated Dr. Sparks' lecture.

Mr. Thomas and Dr. Sparks have been prominently associated with the commercial development of this versatile polymer, and are the authors of many scientific articles on the subject.

Dr. J. C. Patrick, one of the pioneer inventors of synthetic rubber in this country, also attended the meeting and was honored by a round of applause when presented to the group.

Adding to Elastomers Laboratory

E. I. du Pont de Nemours and Co., Inc., Wilmington, Del. has announced plans to construct a half million dollar addition to its recently completed Elastomers Laboratory at the Chestnut Run site to expand customer service and develop new uses for urethane foams. The new wing will include pilot plant facilities, machinery and other equipment for mixing and fabricating foams. The Elastomers Laboratory was opened in the spring of this year to provide technical service on all the rubber chemical products. It is probably the largest and most complete unit of its kind ever assembled, the company states. Completion of the new wing is expected by late Spring 1957.

NEW POLYESTER RUBBER CITED DURING RECENT A.C.S. MEETING

At a meeting of the Division of Polymer Chemistry of the American Chemical Society held on September 17 at the Marlborough-Blenheim Hotel in Atlantic City, N. J., G. C. Schweiker and Paul Robitschek of the Hooker Electrochemical Co., Niagara Falls, N. Y., reported a new rubber which, according to preliminary tests, can withstand the heat of supersonic jets, the frigid temperature of the upper air and the attack of fuels, lubricants and hydraulic fluids.

Strong and elastic after long exposure to air at 400°F. and flexible down to about —98°F. the material is resistant to both aromatic and paraffinic-type fuels and to certain hydraulic fluids used in present day planes, according to Dr. Schweiker. The rubber was described as "a polyester made from adipyl chloride and a diol comaining fluorine."

Only last May, at a meeting of the Society's Division of Rubber Chemistry in Cleveland, it was stated that no rubber then available would function in contact with jet engine lubricants above 300°F. and also remain flexible at —65°F. Many of the high-speed aircraft the armed forces are planning "will never progress beyond the design stage" unless the nation's rubber technologists develop suitable new synthetic rubbers, a speaker warned the Cleveland meeting, Dr. Schweiker recalled.

Rubber Indispensability

Rubber is one of the indispensable materials for the operation of modern equipment and machines, Dr. Schweiker pointed out. In supersonic aircraft it is vital for fuel and hydraulic systems as well as for other aircraft parts. Heat resistant materials are a serious need, he asserted, adding:

"On the one hand is the problem of heat generated by air friction on such aircraft and by the more powerful engines required for their propulsion. Conversely, there is the danger of possible failure of materials by embrittlement when aircraft are based in cold climates or are cruising in cold air at subsonic speed. Because the properties of presently known elastomers fall short of one or more of the new requirements, very considerable research has been expended on this problem of discovering a fuel and solvent-resistant rubber capable of efficient performance at both high and low temperatures."

Hooker Electrochemical started research work on this problem several years ago under contract with the Materials Laboratory, Wright Air Development Center, U. S. Air Force, Dr. Schweiker stated. The problem was attacked by including fluorine in the long rubber molecules, something which other researchers had done but in a different way, he explained.

"One of the main differences in the Hooker work is that the fluorine is incorporated into the molecule in a regularly defined way to permit freedom of rotation between small segments of the long polymeric chain," he said. "In this manner low temperature flexibility and also fuel and solvent resistance and thermal stability are maintained by the polymer.

"Research, however, continues on this general problem. The requirements for superior elastomers are becoming increasingly exacting, especially with regard to thermal stability. By meeting certain requirements, the new experimental Hooker rubber has also pointed the way to a family of related fluorine-containing elastomers which will require additional research to prepare and evaluate."

C. C. DAVIS ANNOUNCES RETIREMENT FROM BOSTON WOVEN HOSE

Carroll Campbell "C. C." Davis, chief chemist of the Boston Woven Hose and Rubber Co., Boston, Mass.; editor of *Rubber Chemistry and Technology*, and Goodyear Medalist (1950) of the Division of Rubber Chemistry, American Chemical Society, retired on October 1, after 42 years with his company. Mr. Davis is one of the rubber industry's most widely-known figures and in his editorial capacity, he is considered to be the person most responsible for the present, wide-spread availability of technical rubber information throughout the world.

C. C. Davis

Associated with the Boston Woven Hose & Rubber Co. since 1914, Mr. Davis established his world-wide reputation in 1924 and 1925 when, in collaboration with the company's present president, John M. Bierer, he announced the first practical oxygen-aging test in the industry, and the use of antioxidants in rubber. These papers were followed by publication, again with Mr. Bierer, of other technical papers in 1926 and 1927 on reclaimed rubber and specifications, respectively.

Always active in the rubber field, Mr. Davis has been abstractor since 1919, and editor since 1925, of *Chemical Abstracts*. In 1928 he became the first editor, a position he still holds, of *Rubber Chemistry & Technology*. In 1937, the 74th A. C. S. monograph, "The Chemistry and Technology of Rubber", was published with Mr. Davis as editor and John T. Blake as associate editor, and in 1954, with R. F. Dunbrook, he assisted G. S. Whitby in editing "Synthetic Rubber", a monograph prepared under the direction of the Rubber Division. Mr. Davis has also contributed several articles on rubber to annual reviews and engineering handbooks and has served 13 years as section editor of "Rubber Bibliography", published by RUBBER AGE for the Rubber Division. He plans to continue some of his editorial work in his retirement.

Born in West Roxbury, Mass., Mr. Davis attended the local schools and later Dartmouth College, where he received a B.S. in chemistry in 1911. He studied widely in engineering at M. I. T. and received the S.B. degree in chemical engineering in 1914.

Dedicates Research Laboratory

A new research laboratory building for the J. T. Baker Chemical Co., Phillipsburg, N. J., was dedicated on October 26. More than 20,000 square feet of floor space are available for laboratories, services, the research library and for the offices of the Research Division and chemist-analyst. Facilities are provided for a research staff of sixty. Designed to provide for easy expansion, the building has removable "window-walls" for future installation of unusually large equipment. The two-level area occupied by Baker's research library maintains close to 10,000 volumes in the field of chemistry and allied sciences. The facilities are designed to expand the company's chemical development program.

I. C. I. Opens New Laboratories

The Plastics Division of Imperial Chemical Industries, Ltd., has opened new laboratories near London, England, designed to facilitate the development of new and better raw materials for the plastics industry. The laboratories have a working area of 56,000 square feet and house chemical and physical laboratories as well as equipment used in commercial production of plastic articles. There are seven fabricating laboratories which contain up-to-date semi-scale or full-scale equipment covering all the standard processing and manipulative operations with which the plastics industry is normally concerned. As an associate company of Imperial Chemical Industries, Canadian Industries, Ltd., Montreal, P.Q., has access to the facilities and developments of these new laboratories. However, the Canadian concern expects to continue to depend on its own Canadian laboratories for technical service and most application development work in the plastics field.

A blood administration set made by Abbott Laboratories, North Chicago, Ill., utilizes Geon polyvinyl material in the plastic filter chamber, making blood transfusions safer and more dependable.

SIGNAL CORPS LABORATORIES PLANS WIRE AND CABLE SYMPOSIUM

The Fifth Annual Symposium on "Technical Progress in Communication Wires and Cables", jointly sponsored by the Signal Corps Engineering Laboratories, Fort Monmouth, N. J., and the industry, will be held on December 4, 5 and 6 at the Berkeley-Carteret Hotel in Asbury Park, N. J. Registration for the symposium, which is being held under the auspices of the Telecommunications Division of the Laboratories, will begin at 4:00 P.M. on December 3. Morning and afternoon technical sessions have been planned for Tuesday and Wednesday, December 4 and 5, and the technical program will conclude with the morning session on December 6.

A "hospitality hour" has been scheduled for 5:30 P.M. on Tuesday, December 4, and a banquet will be held beginning at 8:00 P.M. on Wednesday, December 5. Persons interested in the symposium should address their inquiries to Wire and Cable Symposium Committee, Communications Department, SCEL, Fort Monmouth, N. J., Attention: Mr. H. L. Kitts (Phone: Eatontown 3-1000, extension 5-1565). The symposium program follows:

Tuesday Morning—December 4

Technical Session — Chairman, H. L. Kitts, Chief, Outside Plant Branch, SCEL.

Welcoming Address—Brigadier General Earl F. Cook, Commanding General, SCEL.

"Kel-F 500, a New Fluorocarbon Wire Insulating Material", by J. A. Jupa, M. W. Kellogg Co.

"Properties of Hypalon Wire Coverings", by F. W. Keely, E. I. du Pont de Nemours & Co.

"Zytel Nylon Resin in Wire and Cable", by A. L. Gibson, E. I. du Pont de Nemours & Co.

"High Speed Color Coding of PVC Insulated Wire", by W. L. Hoff, Western Electric Co.

Tuesday Afternoon—December 4

Technical Session—Chairman, M. Tenzer, Chief, Microwave and Electromechanical Branch, SCEL.

"Resistance of Rubber Covered Cable, Jacket, and Insulation Stocks to Weather and Artificial Aging", by J. W. Bryden, P. Mitton, F. Ruppert, and M. Smith, Engineer Research & Development Labs., Fort Belvoir, Va.

"Aging of Neoprene in a Weatherometer", by G. N. Vacca, Bell Telephone Laboratories.

"The Effect of Carbon Black Surface Properties on the Stability of Polyethylene", by J. T. Moynihan, Acheson Dispersed Pigments Co.

"New Developments in Cable Jacketing Compounds", by D. W. Dahringer and W. T. Higgins, Bakelite Co.

"Sub-Miniature Coaxial Cable R. F. Power Ratings and Connector Characteristics", by G. J. Mares and N. J. Sladek, Amphenol Electronics Corp.

Wednesday Morning—December 5

Technical Session — Chairman, W. R. Krueger, Chief, Line Facilities Section, SCEL.

"New Developments in Silicone Rubber Compounds for Extruded Electrical Insulation", by M. G. Noble, General Electric Co.

"New Developments in Silicone Rubber Compounds for Electrical Tapes", by J. S. Hurley, Jr., General Electric Co.

"High Power, Low Noise Pulse Cables", by R. Feller, Okonite Co., and J. Agrios, Signal Corps Engineering Laboratories, Fort Monmouth, N. J.

"Advantages and Limitations of Aluminum Wire and Cable", by H. R. Stoddard, R. E. Gross and G. A. Snow, Simplex Wire & Cable Co.

"Submarine Cable Activities at the U.S. Navy Electronics Laboratory" by G. V. Williams, U.S. Navy Electronics Laboratory, San Diego, Calif.

Wednesday Afternoon—December 5

Technical Session—Chairman, H. F. X. Kingsley, Chief, Wire and Cable Section, SCEL.

"Insulated Parallel Circuit with Air Dielectric for Rural Telephone Service", by W. T. Smith, C. R. Ballard and R. S. Bailey, Rural Electrification Administration, U.S. Dept. of Agriculture.

"C-Rural Wire", by A. P. Jahn, Bell Telephone Laboratories.

"Hifax Potentials in the Wire and Cable Industry", by E. W. Cronin, J. B. Martin, and W. O. Bracken, Hercules Powder Co.

"Some Considerations on the Use of High Density Polythene in the Cable Industry", by D. Grant, Imperial Chemical Industries, Welwyn Garden City, England.

"Effect of Radiation on Polyethylene", by V. L. Lanza, Bell Telephone Laboratories.

"The Use of Irrathene Irradiated Polyethylene in Wire and Cable", by Dr. K. J. MacKenzie, General Electric Co.

Thursday Morning—December 6

Technical Session — Chairman, F. W. Wills, Wire and Cable Section, SCEL.

"A Sealing Connector for Small Insulated Conductor", by E. N. Bollmeier, Minnesota Mining & Manufacturing Co.

"The Paste Extrusion of Teflon 6 Tetrafluoroethylene Resin for Wire Insulation", by D. DeYoung and G. R. Snelling, E. I. du Pont de Nemours & Co.

"A Practical Approach to the Extrusion of Thermoplastics", by W. Hooper, E. I. du Pont de Nemours & Co.

"How to Predict Extruder Performance", by B. H. Maddock and P. Wilton, Bakelite Co.

Non-Sticking Rubber Compound

Goshen Rubber Co., Inc., Goshen, Ind., has developed a new rubber compound with outstanding non-sticking properties which, the company says, make the material ideal for valve seat and other applications. Named "Compound No. 1318", the material gives quick break-away without lubrication. The compound has excellent bonding-to-metal properties, the company reports. Recommended temperature range is from —40°F. to +300°F.

Use Of Winter Tires Increases

Recent estimates by the Rubber Manufacturers Association, Inc., show that more than 20,000,000 winter tires rolled on United States highways last winter. The estimates, the first ever made by the industry on this special purpose casing, were based on the findings of the Crowell-Collier survey of the automotive and allied industries. The report disclosed that the use of winter tires had more than doubled between the 1952-53 and the 1955-56 seasons. On a national basis, the study shows, the special casings were used by one in every five motorists. However, the proportions vary in accordance with regional weather conditions, with more than two out of five cars using winter tires in the snow belts of the central states. On the strength of the rapid market growth shown in the survey, the industry anticipates an even greater demand during the 1956-57 season. Safety as well as traction features of the tire are being stressed by dealers throughout the country in connection with the nationwide "Safe Tires Save Lives" campaign, launched by the tire industry under the auspices of the Inter-Industry Highway Safety Committee.

New Firestone Winter Tire

Firestone Tire and Rubber Co., Akron, Ohio, has announced a new "triple-action traction" tire for driving on snow and ice. The new tire, called "Town and Country", offers maximum protection against skidding by the use of deep-biting traction bars that dig into soft mud and snow to give greater pulling power, Firestone states. These traction bars are designed to automatically clean themselves of snow or mud giving firm traction on any surface. Hundreds of cross grooves in the tread ribs and angular edges that resist side skidding on slick surfaces provide added flexibility, closer contact to road surfaces and assure safe stops and starts, Firestone says. The tire runs noiselessly on dry pavements and is compounded with a special ingredient that provides greater mileage on dry roads. Designed especially to blend with the long, low look of the newer cars, the Town and Country has white sidewalls that are protected from curb scuffing by a rubber guard. It is available in the 14-inch size in rayon or nylon cord, tubeless or for use with tubes.

Goodrich De Luxe Silvertown

A tubeless passenger tire with a narrower white sidewall in both 14 and 15-inch sizes has been introduced by B. F. Goodrich Co., Akron, Ohio. The new "De Luxe Silvertown" has been re-engineered inside and out, the company says, for better appearance, easier ride and improved safety performance. The new tire has been especially designed for the higher powered 1957 automobiles. More than 80% of 1957 cars are expected to be equipped with 14-inch tires. The narrower sidewall of the new Goodrich casing gives the tires a smaller appearance which adds to the longer, lower look of the new cars. This also made it possible to lower the curb guard to give the whitewall better protection from scuffing.

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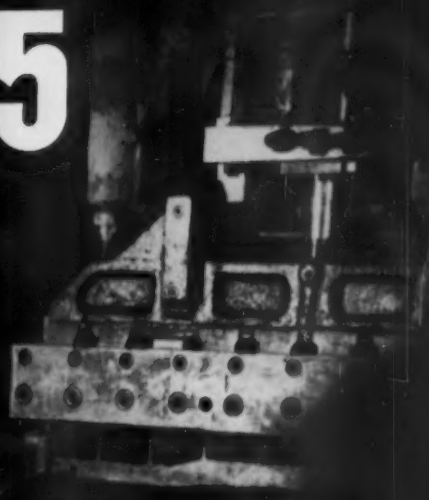

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(Medium Processing Channel)

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STATEX-B FF
(Fine Furnace)

STATEX-M FEF
(Fast Extruding Furnace)

STATEX-93 HMF
(High Modulus Furnace)

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AKRON RUBBER GROUP HEARS SYMPOSIUM ON SOFTENERS

A "Symposium on Softeners for the Compounding of Rubbers" was the feature of the technical meeting of the Akron Rubber Group, held at the Sheraton-Mayflower Hotel in Akron, Ohio, on the afternoon of October 26. Approximately 350 members and guests were in attendance at the session.

The Symposium covered four separate types of softeners, namely, those derived from petroleum, pine and coal tar products, as well as the ester type, low temperature plasticizers. The panelists, each of whom delivered a short talk on his alloted subject, and then participated in the question-and-answer period, were: *Petroleum Products,* S. S. Kurtz, Jr. (Sun Oil); *Pine Products,* Lyle Amberg (Hercules Powder); *Coal Tar Products,* Paul O. Powers (Pennsylvania Industrial Chemical); *Plasticizers,* Max A. Pollack (Wallace-Tiernan).

The moderator was A. E. Juve, of the B. F. Goodrich Co., immediate past-chairman of the Division of Rubber Chemistry, A.C.S. In his introductory remarks, Mr. Juve stressed the difficulties involved in the proper definition of "softeners" as applied to rubber compounding. He indicated the term would seem to imply "that addition of such a material would produce a softening, either of the uncured mix or of the vulcanizate." He added that frequently it does both, but in special cases it does one and not the other.

Mr. Juve also outlined the specific purposes for which softeners are used, such as reducing the viscosity of the mix, tackifying, diluting, lowering hardness, improving ozone resistance, and activating the cure. He estimated that there are approximately 265,000 long tons of softeners consumed in the rubber industry per year. This figure, he said, excludes fatty acids and resin acids present in GR-S which amount to approximately 37,000 long tons. (EDITOR'S NOTE: The talks given at the Symposium, as well as the questions and answers, will be published in the January, 1957, issue of RUBBER AGE.)

Reports at Dinner Meeting

Following the usual excellent dinner, a short business session was held, presided over by H. M. Brubaker (Witco Chemical), chairman of the group. Mr. Brubaker first paid special tribute to the members of the Outing Committee for the success of the summer outing, and then introduced the various people seated on the dais, including the panelists and the moderator of the afternoon symposium.

Ken Garvick (Mansfield Tire) then reported for the Education Committee and briefly outlined the plans for the advanced course in rubber technology which will be launched under group auspices at the University of Akron next January or February. He also introduced three of the four students presently attending the University under group fellowships. Mr. Garvick was presented with a plaque as immediate past-chairman of the group.

A report from the Membership Committee indicated that as of October 26 the group had a total of 1112 paid members, a record for local rubber groups. The Auditing Committee reported that a check had been made of finances and everything was found to be in order. As of August 1, 1956, the treasury contained $6,378.00.

The speaker for the evening was Harrison Dillard, Olympic champion, who gave an interesting talk, including personal reminiscences, of the last few Olympics. He also traced the history of the Olympic games. Mr. Dillard is currently associated with the public relations department of the Cleveland Ball Club.

B. F. GOODRICH CHEMICAL CO. MOVES TO NEW QUARTERS IN CLEVELAND

A gleaming, new, three-story office building with a facade containing granite panel curtain walls with wide expanses of open glass is the new home of the B. F. Goodrich Chemical Co. in Cleveland, Ohio. General sales and executive offices of the chemical company are now located at 3135 Euclid Avenue in the new building which was constructed and leased on a long-term basis to Goodrich Chemical by the Mintz Construction Co., Cleveland. Approximately 300 people will occupy the new building. Technical staffs, engineering and purchasing will house the first floor together with the Personnel Department and library facilities. Sales order service and accounting occupy the second floor. Executive offices, sales department, and advertising are located on the third floor. A major conference room is located in the basement which also houses the telephone exchange, duplicating room, advertising stock, vault, and storage area.

The three-story building measures 90 feet by 147 feet with a gross area of 52,000 square feet, including basement. The building is fully air-conditioned with self-washing electronic air filters. It has acoustical ceilings, fluorescent ceiling lighting which switches on instantaneously, and self-operating passenger elevator. Off-street hard surface parking space to accommodate approximately 100 automobiles is provided at the rear of the building.

Announces Calvert City Plant

Plans to construct a new $2,500,000 plant to manufacture specialty acrylic polymers at Calvert City, Ky., have been announced by the B. F. Goodrich Chemical Co., Cleveland, Ohio. The plant will bring the company's investment in plant and equipment at Calvert City to more than $17,000,000. Present facilities include units for the manufacture of vinyl chloride monomer and acrylonitrile. The new plant will consist of three buildings, a shop, a warehouse and a process building. Construction of the first two buildings has already begun and is expected to begin on the third immediately. Completion is expected by October, 1957.

Elected First Vice-President

R. W. Nickles, formerly vice-president of the Faultless Rubber Co., Ashland, Ohio, has been elected first vice-president of the company. Other officers elected include: T. W. Miller, Jr., chairman of the board and president; Western Wiles, vice-president in charge of sales; Charles W. Ebert, secretary-treasurer; R. L. Charlton, assistant treasurer, and R. E. Kreider, assistant secretary. At a stockholders' meeting held on September 28 in Ashland, the following were elected to the company's board of directors: Mr. Nickles, Mr. Miller, C. D. Hubler, Frederick Lobl, William A. McAfee and Mr. Wiles. In other company appointments, Kenneth Darr, formerly on the sales staff of the Industrial Products Division, was appointed products manager of the Foremost Division. Jack Harris, previously products manager in charge of sponge rubber balls and balloon sales, was named manager of the Foremost Division.

A reliable, low cost pump, specifically designed to handle corrosives and hazardous liquids, is now available for special purpose jobs in the chemical and allied process industries from the Eco Engineering Co., Newark, N. J.

NEW YORK HOLDS SYMPOSIUM; ELECTS OFFICERS FOR 1957

Over 200 members and guests of the New York Rubber Group attended the Fall Meeting held on October 5 at the Henry Hudson Hotel in New York City. The meeting featured a "Symposium on Mechanical Rubber Goods" and the election of officers for the 1957 season. The following members were elected to office: *Chairman*, H. J. Due (St. Joseph Lead); *Vice-Chairman*, C. V. Lundberg (Bell Telephone Labs); *Secretary-Treasurer*, R. G. Seaman *(Rubber World)*. N. Cooperman (National Lead) was elected sergeant-at-arms. New directors elected for three-year terms are R. Emmett (Columbian Carbon), M. W. Gall (Luzerne Rubber), L. J. Radi (R-B-H Dispersions), and Ralph DeTurk (Whittaker, Clark & Daniels).

Mr. Lundberg, the new vice-president, was presented with a Polaroid Camera by the group in appreciation of his efforts as chairman of the Educational Committee. Mr. Lundberg supervised the presentation of the first course in elastomer technology ever undertaken by the New York Rubber Group.

Six panel members participated in the "Symposium on Mechanical Rubber Goods" which featured the technical portion of the meeting. Panel members and their subjects were: *Belting*, W. L. White (Manhattan Rubber); *Hose*, J. A. Muller (Thermoid Rubber); *Small Molded Goods*, C. A. Sobierajski (U. S. Rubber); *Cellular Rubber Goods*, George Sprague (Goodrich Sponge); *Compounding*, B. B. Boonstra (Godfrey L. Cabot); *Equipment*, E. H. Johnson (Farrel-Birmingham). M. E. Lerner, editor of RUBBER AGE, served as moderator. A complete report on the Symposium, including the short talks presented by each panelist and the questions and answers, appears elsewhere in this issue.

The meeting also featured a cocktail hour and a dinner. Following dinner, a program of entertainment was presented by the "Mystics", a mind-reading act. Plans are under way for the Annual Christmas Party which will be held on December 14 at the Henry Hudson Hotel in New York City.

Ameripol SN In Production

First pilot plant production of synthetic rubber that duplicates tree rubber has begun in a new plant of Goodrich-Gulf Chemicals, Inc., at Avon Lake, Ohio. The new rubber, named "Ameripol SN", will be made available to other companies for testing purposes. The material has been tested principally by Goodrich in the manufacture of large truck tires, one of the major areas of use where tree rubber has remained preferred to man-made materials. Tires made entirely of Ameripol SN are giving highway service and mileage in fleet operations comparable to that of tires made wholly of natural rubber, the company states. In addition, military truck tires made of Ameripol SN have been found superior to standard truck tires in Army Ordnance tests. Goodrich recently announced that the new material may replace natural rubber as protective linings or coverings against certain types of chemical corrosion where the natural product has been in a class by itself. The company has produced the new rubber in small quantities for more than a year while the new plant was being constructed.

SPE Plans 13th Conference

A number of interesting papers are scheduled for presentation at the 13th Annual Technical Conference of the Society of Plastics Engineers, Inc., which will be held on January 16-18 at the Sheraton-Jefferson Hotel in St. Louis, Mo. Morning and afternoon sessions are planned on Wednesday and Thursday, January 16 and 17, and the meeting will conclude with the morning sessions on Friday, January 18. A cocktail party and president's reception will be held at 6:00 P.M. on January 17 and this will be followed by a banquet at 7:00 P.M. Among the technical sessions planned is one on "Foam" which will feature a paper on "Use and Application of Isocyanate Foams" by Benjamin S. Collins (Nopco Chemical). Other technical sessions cover such subjects as "Extrusion", "Injection Molding", Reinforced Plastics", "Instrumentation", "Compression Molding", etc.

QUEBEC HOLDS GOLF OUTING; HEARS ADDRESS BY STEWART

The Quebec Rubber and Plastics Group opened its 1956-57 season on September 28 with a meeting that took the form of a combined golf outing and stag dinner at the La Salle Golf and Country Club, Ville La Salle, Quebec, Canada. Over 55 members and guests were in attendance at the stag dinner which featured a program of games and entertainment by a ventriloquist.

On October 18, the Quebec Group held its first technical meeting of the new season. The meeting was held at the Queens Hotel in Montreal, with 65 members and guests present. Principal speaker of the meeting was Dr. W. W. Stewart, sales manager of the Chemical Products Division of Imperial Oil, Ltd. Dr. Stewart discussed the petrochemicals industry in Canada.

The speaker demonstrated the close interrelationship between the petrochemical industry and the rubbers and plastics industries by listing various rubber and plastics, the raw materials for which are supplied by the petrochemical industry. He reviewed the history of petrochemicals in Canada which began in 1942 with the construction of a synthetic rubber plant by the Polymer Corp. at Sarnia, Ont.

Dr. Stewart went on to discuss the tremendous market potential which exists in Canada. He noted that only 50 pounds of petroleum products are used per person per year in Canada, while in the United States, 200 pounds per person per year are used. The speaker opined that the years from 1960 to 1965 will be banner years for the Canadian petrochemical industry.

In another part of his talk, Dr. Stewart described the manufacturing operations involved in petroleum processing. He illustrated his talk with slides.

Vinyl Linens, Inc., New York, N. Y., has used pastel colored Vinylfoam for the casing of a new inflatable pillow that is light in weight and completely collapsible. The pillow can be fixed into position on any smooth surface by means of suction cups.

Shown above are the panel members and the moderator at the New York Rubber Group Symposium on Mechanical Rubber Goods held on October 5 in New York City.

BOSTON GROUP HEARS TALKS BY LOUGHBOROUGH AND BAUMAN

The October 5th meeting of the Boston Rubber Group, held at the Somerset Hotel in Boston, Mass., attracted approximately 170 members and guests. Principal speakers at the meeting were Dr. D. L. Loughborough, director of physical research at the B. F. Goodrich Research Center, and Dr. R. G. Bauman, chairman of the Nuclear Development Group at the Center. The after-dinner speaker was "Bill" Stewart, former National League umpire.

In his remarks on "The Significance of Radiation in the Rubber Industry", Dr. Loughborough offered a review of the fields in which radiation is now being successfully employed. His remarks served as an introduction to the paper presented by Dr. Bauman on "Some Specific Effects of Radiation Upon Monomers and Polymers."

Dr. Bauman noted that nuclear radiation of many types, gamma rays, neutrons, or beta rays, may cause marked effects on monomers and polymers. They may cause the polymerization of monomers and either crosslinking or scission of polymers. Since 1933, the B. F. Goodrich Co. has been interested in the use of this crosslinking action of high-energy radiation to cure rubber. Through the use of gamma radiation from the radioisotope, Cobalt-60, many different types of elastomers have been cured. Hevea, GR-S type rubber, Hycar 1001, Neoprene GN, Neoprene W, Ameripol SN, Kel-F and polyacrylates may be cured in this way. Butyl and Thiokol type rubbers undergo primarily chain scission and cannot be readily cured, Dr. Bauman stated.

Irradiation cures appear superior to sulfur cures but not perioxide cures with respect to resistance to aging. At similar states of cure, radiation cures show equivalent solvent resistances, resiliences, permanent sets and hardnesses, lower dynamic moduli, and higher abrasion resistances and hysteresis values. The tensile properties resemble those of peroxide cures, i.e., slightly lower ultimate tensiles and much lower ultimate elongations than sulfur cures. The exception to this is loaded Hycar 1001 which gives radiation cures equivalent to the best sulfur cures, the speaker observed.

Most tire cords fail with no property improvements under irradiation. Dacron appears most resistant. The shrinkage tension of nylon is decreased, but only at a simultaneous sacrifice of tensile strength, he declared. Most cured rubber goods are damaged by radiation. Butyl and Thiokol rubbers become soupy. The remaining rubbers cross-link and become "over-cured". Certain organic chemicals which are called "Anti-Rads" act to inhibit this damage, Dr. Bauman concluded.

Richardson Builds Laboratory

Richardson Co., Melrose Park, Ill., has announced that construction of a research and development laboratory adjacent to its executive offices has begun. The unit is expected to be in operation next July.

Coming Events in the Rubber Industry

Dec. 4-5. Society of the Plastics Industry, Seventh Film, Sheeting and Coated Fabrics Division Conference, Commodore Hotel, New York, N. Y.

Dec. 5. Buffalo Rubber Group, Xmas Party.

Dec. 6. Fort Wayne Rubber & Plastics Group, Hotel Van Orman, Fort Wayne, Ind.

Dec. 7. Detroit Rubber & Plastics Group, Xmas Party, Sheraton-Cadillac Hotel, Detroit, Mich.

Dec. 7. Northern California Rubber Group, Xmas Party, Orinda Country Club.

Dec. 14. Boston Rubber Group, Xmas Party, Hotel Somerset, Boston, Mass.

Dec. 14. New York Rubber Group, Xmas Party, Henry Hudson Hotel, New York, N. Y.

Dec. 15. Southern Ohio Rubber Group, Xmas Party.

Dec. 21. Chicago Rubber Group, Xmas Party, Morrison Hotel, Chicago, Ill.

Jan. 17, 1957. Quebec Rubber & Plastics Group, Joint Meeting with the Quebec Section of the Society of Plastics Engineers.

Jan. 25, 1957. Akron Rubber Group, Mayflower Hotel, Akron, Ohio.

Jan. 25, 1957. Philadelphia Rubber Group, Poor Richard Club, Philadelphia, Penna.

Feb. 7, 1957. Fort Wayne Rubber & Plastics Group, Van Orman Hotel, Fort Wayne, Ind.

Feb. 15, 1957. Chicago Rubber Group, Furniture Mart, Chicago, Ill.

Feb. 21, 1957. Quebec Rubber & Plastics Group, Ladies' Night.

Mar. 15, 1957. Chicago Rubber Group, Furniture Mart, Chicago, Ill.

Mar. 18-21, 1957. Society of the Plastics Industry, Annual National Conference, Los Angeles-Biltmore Hotel, Los Angeles, Calif.

Mar. 22, 1957. New York Rubber Group, Henry Hudson Hotel, New York, N. Y.

Apr. 5, 1957. Akron Rubber Group, Spring Meeting, Mayflower Hotel, Akron, Ohio.

Apr. 11, 1957. Fort Wayne Rubber & Plastics Group, Van Orman Hotel, Fort Wayne, Ind.

Apr. 18, 1957. Quebec Rubber & Plastics Group.

Apr. 26, 1957. Chicago Rubber Group, Furniture Mart, Chicago, Ill.

May 15-17, 1957. Division of Rubber Chemistry, A.C.S., Joint Meeting with Rubber Chemistry Division of C.I.C., Sheraton-Mount Royal Hotel, Montreal, Que., Canada.

June 7, 8, 9, 1957. Los Angeles Rubber Group, Summer Outing, Sahara Hotel, Las Vegas, Nevada.

June 7, 1957. Fort Wayne Rubber & Plastics Group, Summer Outing, Lake Tippecanoe, Leesburg, Ind.

June 20, 1957. Quebec Rubber & Plastics Group, Golf Tournament.

June 21, 1957. Akron Rubber Group, Summer Outing.

Sept. 11-13, 1957. Division of Rubber Chemistry, A.C.S., Fall Meeting, Hotel Commodore, New York, N. Y.

Sept. 26, 1957. Fort Wayne Rubber & Plastics Group, Van Orman Hotel, Fort Wayne, Ind.

Oct. 4, 1957. New York Rubber Group, Henry Hudson Hotel, New York, N. Y.

Oct. 25, 1957. Akron Rubber Group, Fall Meeting, Mayflower Hotel, Akron, Ohio.

Dec. 5, 1957. Fort Wayne Rubber & Plastics Group, Van Orman Hotel, Fort Wayne, Ind.

Dec. 13, 1957. New York Rubber Group, Henry Hudson Hotel, New York, N. Y.

May 14-16, 1958. Division of Rubber Chemistry, A.C.S., Spring Meeting, Netherlands Plaza Hotel, Cincinnati, Ohio.

CENSUS BUREAU REPORTS ON RUBBER INDUSTRY—NOT ELSEWHERE CLASSIFIED

According to preliminary results obtained from the 1954 Census of Manufactures conducted by the Bureau of the Census, Department of Commerce, manufacturers in the rubber industry (not elsewhere classified), shipped products valued at $1,677,000,000, an increase of 77% over 1947. Average employment in this industry increased 19% since 1947 (when the last Census of Manufactures was taken) to a total of 133,400 employees in 1954. Value added by manufacture in the industry amounted to $930,000,000 in 1954, an increase of 79% over 1947.

"Value added" is derived by subtracting the cost of materials, etc., from the value of shipments. It avoids, therefore, the duplication in the value of shipments which results from the use of products of some establishments as materials by others and is the best value measure available for comparing the relative economic importance of manufacturers among industries and geographic areas. All figures in the report are preliminary and, therefore, subject to revision in the final industry bulletin.

This segment of the rubber industry represents manufacturing establishments engaged primarily in the manufacture of industrial and mechanical rubber goods, rubberized fabrics and vulcanized rubber clothing, and miscellaneous rubber specialties and sundries. Establishments primarily engaged in rebuilding and retreading tires for the trade, or for sale at wholesale are included in this segment, but the rebuilding or retreading of rubber tires by tire-repair shops is classified in "Service Industries" covered by the 1954 Census of Business. The industry classification for the Rubber Industry, (not elsewhere classified), used in the 1954 Census of Manufactures is based on the Standard Industrial Classification.

Value of Shipments

The value of shipments, as reported by establishments classified in the Rubber Industry, (not elsewhere classified), consisted not only of products described above as primary to the industry, but also included the value of secondary products (which are primary to other industries). The $1,677,000,000 total value of shipments reported by establishments classified in Industry 3099, Rubber Industry, (not elsewhere classified), consisted of $1,664,000,000 manufactured products and $13,000,000 miscellaneous receipts for contract work, repair work, sales of scrap, etc. The $1,644,000,000 product shipments were accounted for by $1,456,000,000 of rubber goods, not elsewhere classified, and $208,000,000 of products primary to other rubber industries.

Thus, the industry's shipments of rubber goods, (not elsewhere classified), represented 87% of its total manufactured product shipments (primary and secondary). This figure describes the "primary product specialization ratio," that is, the extent to which plants classified in an industry "specialize" in making products regarded as primary to the industry. The 1947 primary product specialization ratio for the industry was 85.

The industry's total value of shipments should be clearly distinguished from the total value of primary products of the industry shipped by all producers. The latter figure, indicates that $1,744,000,000 value of rubber products, (not elsewhere classified) and other products primary to Industry 3099 was shipped by all producers. Of this total, 83% was shipped by plants classified in Industry 3099, while the remainder were shipped as secondary products by plants classified in other industries. The figure 83% is known as the "coverage ratio," that is, it measures the extent to which all shipments of primary products of an industry are "covered" by plants classified in that industry, as distinguished from secondary producers elsewhere.

The general statistics (employment, payrolls, cost of materials, value of shipments, etc.) are reported for each establishment as a whole. Aggregates of such data for an industry reflect not only the primary activities of the establishments in that industry, but also their activities in the manufacture of secondary products and receipts for their other activities (contract work on materials owned by others, repair work, etc.)

To Publish Additional Figures

More detailed figures for this industry will appear in the Census Bulletin, MC-30A, "Rubber Products," which will be published and offered for sale at a later date by the Superintendent of Documents, U. S. Government Printing Office. Also, in this bulletin, there will be a comprehensive discussion of such concepts as "industry," "establishment," "secondary production," as well as the various statistical items such as "employment," "value added," etc.

Similar advance reports and final bulletins will be issued for other industries during the coming months. A summary of preliminary United States totals for general statistics with separate figures for most individual manufacturing industries is now available. Advance reports for individual States have been published and will be followed later in the year by the detailed State bulletins. (Order blanks which list these reports and bulletins and their prices may be obtained from local U. S. Department of Commerce Field Offices or by writing to: Bureau of the Census, Washington 25, D. C.).

The 1954 Census of Manufactures is the twenty-sixth such census of the United States since 1809. For 1954, it was conducted jointly with the Censuses of Business (Wholesale, Retail, and Services) and Mineral Industries, covering continental United States, Alaska and Hawaii. Present legislation provides for a Census of Manufactures every five years, with the next one scheduled to cover 1958. In addition, the law authorizes annual sample surveys to be conducted in interim years.

A new low-priced sponge rubber underlay, designed for volume business, has been introduced by U. S. Rubber. It will be sold direct to retail stores by the company's branch sales organization.

Ameripol SN Tires Tested

Army Ordnance tests of military truck tires made entirely of "Ameripol SN," a synthetic rubber that exactly duplicates tree rubber, demonstrates that the synthetic tires met or surpassed all military requirements, B. F. Goodrich Co., Akron, Ohio, has disclosed. The tests were made over a ten week period at Camp Bullis, San Antonio, Texas, concurrently with identical tests of standard military truck tires. In four areas: tread wear, tire life, tread cutting resistance and tread splice, Ameripol SN tires were found to be superior to standard military truck tires, Goodrich claims.

In the past, heavy duty truck tires, due to heat build up, required natural rubber for most satisfactory performance. General purpose man-made rubber, used in practically all other type tires, proved unsatisfactory for truck casings. Goodrich points out that the production of synthetics, which can satisfactorily take the place of natural rubber, reduces the need for storage of natural rubber and assures the nation of an adequate supply of tires for defense purposes. Goodrich announced recently that Ameripol SN may also replace natural rubber as protective linings or covering against chemical corrosion, a field in which natural rubber has in the past been in a class by itself. Ameripol SN was developed in 1954 by Goodrich-Gulf Chemicals, Inc., jointly owned by Goodrich and the Gulf Oil Corp. Since then, Goodrich-Gulf has produced this product in small quantities for more than a year while a new plant was under construction at Avon Lake, Ohio.

Davis Pays $40,000 Fine

A $40,000 fine has been paid to the Cleveland Federal Court clerk's office by attorneys for Akron industrialist Poncet Davis, who was convicted on four counts involving failure to pay taxes on $738,000 in income. The fine and a five-year sentence, which was later cut to four years, were levied against Mr. Davis last January. Attempts to reduce the sentence have thus far failed, but a new step has been taken in that direction with the plea that Mr. Davis was sentenced under a felony statute when he should have been sentenced under a statute which is considered a misdemeanor. Mr. Davis' attorneys are also negotiating with federal tax men to reduce the $738,000 figure that the government claims Mr. Davis owes. Before a final figure can be reached, Mr. Davis' attorneys said, much work must be done to establish what was Mr. Davis' income and what was income from the Robbins Tire and Rubber Co., Tuscumbia, Alabama.

Russell Appointed Vice-President

Harry A. Russell has been appointed vice-president of the H. O. Canfield Co., Bridgeport, Conn., the company has announced. Mr. Russell will be in charge of technical operations of the company's three plants located in Bridgeport, Conn., Clifton Forge, Va. and Seymour, Ind.

HISTORY OF WIRE INDUSTRY COVERED IN WILLIAMS' TALK

A brief history of the growth of the wire and cable industry in general and a more detailed history of the growth of the cable system of the Consolidated Edison Co. was covered in a talk by David Williams scheduled for presentation before the Wire and Cable Section of the National Electrical Manufacturers Association at Atlantic City, N. J., on November 14. Mr. Williams is manager, Cable Bureau, Purchasing Department, Consolidated Edison Co., New York.

Referring to the early uses of wire and cable, Mr. Williams made mention of the fact that the earliest forms of insulation consisted of cotton cloth saturated with beeswax, paraffin or gum shellac, as well as various types of gutta-percha and rubber compounds. Samuel F. B. Morse, inventor of the telegraph, used an unvulcanized rubber insulated submarine cable between the Battery and Governor's Island, N. Y., in 1841.

According to the speaker, credit for developing the first commercially successful wire to be insulated with a compound containing rubber goes to the Kerite Company of Seymour, Conn. This was accomplished in 1866. A dry paper-wrapped wire, the forerunner of the modern telephone cable, was made in 1872 by John H. Wortendyke, of Richmond, Virginia, for use on the electric bell system in his home. This type of wire was not commercialized until E. O. McCracken, who obtained a patent in 1884, formed the Norwich Insulated Wire Co. The latter company was acquired in 1891 by the National Conduit & Cable Co., a predecessor of the Anaconda Wire & Cable Co.

Traces Wire and Cable Use

Mr. Williams then traced the use of wire and cable in the electric light and power industry, from the first wires for electric arc lighting which were installed overhead along the Avenue de l'Opera in Paris in 1878 to some of the recent, extensive underground installations made by the Consolidated Edison system. He discussed the significance of inventions by Thomas Edison, Gaulard and Gibbs, and Nikola Tesla. When the New York State Legislature decreed in 1884 that all electric wires must be placed underground, it became necessary to develop a flexible cable suitable for installation in underground conduits. The direct current tube system developed by Edison, and made by the Edison Tube Works, predecessor of the Wire and Cable Department of the General Electric Co., was already underground at the time, but it consisted of solid copper rods inserted into iron pipes which were then buried in the ground.

The early experience with rubber had been unsatisfactory, principally because some of the cables had been installed adjacent to steam mains in the city's streets. In 1883, the Standard Underground Cable Co., one of the constituent companies of the General Cable Corp., developed a lead-covered cable insulated with a fibrous covering impregnated with a hydrocarbon compound

David Williams

called "Ozite," which was extensively utilized.

As the art of vulcanizing rubber was perfected, rubber insulation was increasingly used on underground cables. High voltage (1000 volts and over) underground cable installations were made in New York City starting in 1888. These used rubber insulated cables and they were not superseded by paper insulation until 1901. However, on the low voltage distribution system, rubber insulation has superseded paper and varnished cambric in most of the major underground systems of the United States.

Mr. Williams pointed out that over a period of 75 years the voltage of cable for the transmission and distribution of electrical energy in the United States has increased from 120 volts to 330,000 volts on overhead lines, and from 120 volts to 230,000 volts on underground lines. These lines transmit electrical energy from giant thermal and hydroelectric generating stations to the most remote hamlet, the transmission distance having been increased from the ½ mile of Edison's original Pearl St. Station to over 300 miles at the present time. In a few short years, electrical energy will be transmitted from commercial thermonuclear generating stations, Mr. Williams stated.

Outlines Developments

Mr. Williams then outlined the developments which have occurred through the years with wire and cable for various applications. These included developments in oil-impregnated paper, rubber insulated, oil-filled, gas-filled and other types of cables. Latest developments in high voltage cable for the Consolidated Edison system, he declared, include the use of aluminum in place of copper conductors, aluminum in place of lead sheaths, silicone rubber for generator leads, etc.

While butyl rubber compounds are being used for voltages up to 15,000 and have received a wide acceptance on the lines of public utilities, Mr. Williams feels that irradiated polyethylene holds greater promise for use at much higher voltages, i.e., 69,000 to 132,000 volts. The ability of irradiated polyethylene to withstand high temperatures without deterioration, makes it an ideal insulation for use in underground cable systems in large metropolitan areas.

ASME RUBBER DIVISION PLANS ONE-DAY MEETING IN NEW YORK

The Rubber and Plastics Division of the American Society of Mechanical Engineers plans to hold a one-day meeting on November 29 in conjunction with the Annual Meeting of the parent society in New York City. The Rubber and Plastics Division will meet at the Hotel Statler and will be open to non-members of the Society as well as members. The program will consist of two technical sessions, one each in the morning and afternoon of November 29. Papers containing new information and developments on the processing of rubbers and plastics and on a new chlorine-containing polyether will be presented.

Professor James M. Church (Columbia University) will serve as chairman for the technical sessions. C. H. Adams (Monsanto Chemical) will be chairman of the technical session held in the morning of November 29. He will be assisted by Murray Longstreth (Dow Chemical) as vice-chairman. Chairman of the afternoon session will be Sherman Doner (Manhattan Rubber) with W. M. Petry (Akron University) as vice-chairman.

A meeting of the Division's Executive, Advisory and General Committees will be held at noon on November 29. R. G. Seaman (Rubber World) is chairman of the Division for 1956, and F. J. Wehner (Minnesota Mining) is secretary. The possibility exists that preprints of all the papers presented at the Division meeting will be available at the time of the meeting. The following papers are scheduled for presentation.

Morning Session

"The Fundamental Mechanics of Reinforced Plastics", by J. Ogden Outwater, Jr., University of Vermont.

"Penton — A New Chlorine-Containing Polymer", by E. W. Cronin, Hercules Powder Co.

"Electrical Effects Accompanying a Stick-Slip Phenomenon of Sliding of Metals on Plastics and Lubricated Surfaces", by S. M. Skinner, J. Gaynor, and G. W. Sohl, Case Institute of Technology.

"A Review of Developments in Plastics Engineering, 1955-56", by Bryce Maxwell, Princeton University.

Afternoon Session

"Polymer Properties Involved in Process Equipment Design", by H. J. Karam, Dow Chemical.

"Roll Bending Applied to Rubber and Plastics Calenders", by R. C. Seanor, Adamson-United Co.

"High Horsepower Banbury Mixer", by R. N. Comes, Farrel-Birmingham Co.

"Recent Developments in the Field of Mixer-Extruders", by John F. Drew, National Rubber Machinery Co.

"ASCO Solenoid Valves" is the title of a catalog containing engineering information, flow charts, operation and construction details, illustrations, prices, etc., issued by the Automatic Switch Co., 391 Lakeside Avenue, Orange, N. J. Ask for Condensed Valve Catalog, No. 201.

Acquires British Company

U. S. Rubber Co., New York, N. Y., has become the majority stockholder of North British Rubber Co., Ltd., by a recent financial transaction in which existing shareholders were offered a million additional shares on a share-for-share basis at one pound each. Previously holding 50% of the North British stock, U.S. Rubber subscribed for its shares and took the unsubscribed portion of the other 500,000. Consequently, U.S. Rubber will own 74.1% of the total, and the Edinburgh company will become a subsidiary. L. C. Boos, vice-president and general manager of the International Division of U.S. Rubber, states that the additional capital will be used toward financing a modernization program. This program involves an expenditure of approximately $8,500,000 over a five-year period.

"Scottish craftmanship, backed by the resources and technical knowledge of U.S. Rubber, makes the outlook for North British extremely bright," according to Mr. Boos. "These new moves will put the company in a strong competitive position with the other large rubber companies in Britain. The major part of the capital expenditure will be used for modern production machinery for the mechanical goods division. About one-third of the Castle Mills, Edinburgh—one of the company's two plants—will be cleared to make way for a new one-story building of 145,000 square feet. Additional production facilities for making mechanical goods will also be added to the other plant at Dumfries, where all types of canvas and rubber footwear are produced. The remainder of the new capital will go toward a new power plant for the Edinburgh factory and for further modernization of the tire production facilities."

Mr. Boos added that North British, aided by U.S. Rubber technical assistance, plans a large expansion of the lines now being manufactured, and the addition of several new products in the near future. These products include recently developed types of industrial hose, transmission belting, vinyl plastic flooring, non-slip driving belts, molded plastics and sponge products.

Radioisotope Source Facility

Budd Co., Philadelphia, Penna., has announced a new facility to fabricate extremely strong radioisotope sources under license by the Atomic Energy Commission. It is the first commercial facility in this country which will be able to fabricate radioisotopes in strengths up to 10,000 curies. The facility is a part of Budd's new Nuclear Systems Division which also produces radiography equipment for the non-destructive testing of metals and other materials. Basically, the facility consists of a heavily shielded "hot" cell, a master-slave manipulator, a shielding window of more than 36" of high density glass, closed-circuit television and miscellaneous equipment. Among the industries which can utilize radioisotope sources to study the influence of high intensity radiation on their products or processes are: rubber, synthetic resins, food processing, brewing, pharmaceutical, antibiotic, chemical and petroleum.

Radiation Subcommittee Formed

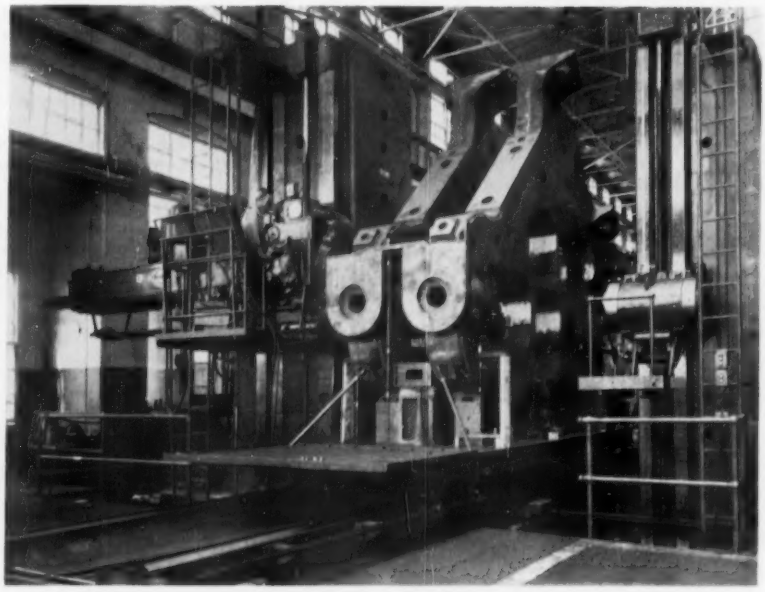
American Society for Testing Materials has announced the formation of a subcommittee to study the effects of nuclear and high energy radiation on the properties of plastics and electrical insulation. ASTM makes the point that the data already existing in the field of radiation effects on materials are in many cases confusing, and instances of outright contradictions are not uncommon. The prime objective of the new subcommittee is to establish, where possible, standard methods of irradiation and standard methods for determining the effects of radiation on the physical and chemical properties of plastics and electrical insulation. The subcommittee on radiation effects, sponsored jointly by ASTM Committee D-20 on Plastics and D-9 on Electrical Insulating Materials, has established sections to work in the following areas: nomenclature and definitions; dosimetry; correlation of various sources of radiation; total dosage and dose-rate effects and post irradiation effects.

Silicone Products Department of General Electric has prepared a four-page "lighting selector" designated "AD 24 E" to facilitate a choice of the proper silicone compound or gum.

To Produce Polyethylenes

National Petro-Chemicals Corp. will be in commercial production of medium-density polyethylenes before the end of this year, according to Dr. Robert E. Hulse, vice-president in charge of chemical activities for the parent company, National Distillers Products Corp., New York, N.Y. A high pressure production technique will be used in Petro's existing polyethylene plant at Tuscola, Ill., to produce these medium-density polyethylenes. The newer materials will be sold under the established trade mark, "Petrothene", through the sales organization of U.S. Industrial Chemicals Co., Division of National Distillers. At the same time, Dr. Hulse announced that total polyethylene production capacity of the Tuscola Plant will be increased to 100,000,000 pounds-per-year by mid-1957. The plant, which came on-stream in February, 1955, had a design capacity of 26,000,000 pounds-per-year but it is currently operating at twice that capacity. Expansion of the polyethylene plant, with attendant expansion of the ethylene, extraction, fractionation, and power plants at the integrated Tuscola petro-chemical complex, is already under way. While the new technique can produce resins with a density range of 0.92 through 0.95, the firm plans to add only resins of medium density.

FARREL-BIRMINGHAM HAS NEW GIANT "Z" CALENDER UNDER CONSTRUCTION



To those familiar with the customary housing design of Farrel-Birmingham "Z" calenders, the pair of calender frames shown on this Sellers 8"-bar horizontal boring mill in the company's Ansonia plant will present an odd appearance. To begin with, they are lying on their front sides and, secondly, a different window arrangement is accounted for by an over-all design improvement in the machine. The housings, each weighing 40 tons, will support the four 32-inch by 86-inch rolls in an *inclined* Z arrangement. The rolls, while retaining the conventional Z formation in relation to one another, will, when inclined as an assembly, permit easier access to all of the rolls, facilitate threading, make possible the mounting of auxiliary equipment closer to the calender rolls, and simplify maintenance. Also crossed axes and roll opening adjustment mechanisms will be more conveniently mounted to give a clearer path for stock travel. To meet the requirements of the customer, Bolta Division of General Tire & Rubber Co., Lawrence, Mass., Farrel-Birmingham has designed this calender to be capable of operating with roll temperatures as high as 500°F.

To Manage Dallas Office

Charles M. White

Godfrey L. Cabot, Inc., Boston, Mass., has announced the appointment of Charles M. White as manager of a new Cabot sales office in Dallas, Texas. The newly opened Dallas branch is the sales office of Cabot Carbon Co., Pampa, Texas, subsidiary of Godfrey L. Cabot, Inc., and will act as sales representative for all parent company products, including both black and white pigments. Among these are a complete range of carbon blacks for rubber, ink, paint, plastics and paper; a new silica pigment called "Cab-O-Sil", and Wollastonite calcium metasilicate. Mr. White has spent three years with the company in the Chicago sales area and his training and experience give him a thorough background in the technical problems of the black and white pigments business. Before joining Cabot he was on the engineering staff of Hood Rubber Co. Mr. White is a graduate of Culver Military Academy and received his B. A. from Williams College in 1949.

Experimental Garage Opened

Goodyear Tire and Rubber Co., Akron, Ohio, has announced the opening of a $300,000 experimental garage designed to test tires. The building will permit immediate, close-at-hand checks of all experimental tires and special projects in the experimental stage. It is located directly north of Goodyear's Plant 3, adjacent to the company's 800 foot straight-away, black-topped test road and 160-foot turn circles. A steel framed, 75 by 250 foot, structure of brick, glass and concrete block, the unit houses complete testing facilities and maintains vehicles used by the company in its tire development program.

Hamilton Elected President

Binney and Smith, Inc., has announced the election of John M. Hamilton as president. Mr. Hamilton, formerly vice-president in charge of sales, succeeds A. F. Kitchel, who was named chairman of the board. The company also announced the election of Lester V. Muffley, general manager of manufacturing, and Victor R. Watson, sales manager, as vice-presidents. Rudolph Ingrisch, vice-president and controller, also was named treasurer.

LABOR NOTES

Delegates to the 20th United Rubber Workers Convention held recently at Long Beach, Calif., voted a fifty cents monthly increase in union dues. Delegates also voted to keep the six-hour day as a union aim. No one proposed making the six-hour day a "must" proposal, so the constitution stays the way that it is—a goal of a six-hour day and a thirty hour week. No local has the thirty hour week at this time. Akron plants, the Los Angeles plant of the Firestone Tire & Rubber Co., and the Detroit plant of the U. S. Rubber Co. have a six-hour day but work six days a week. Other plants work eight hours a day—forty hours a week.

Another union election has been held at Rempel Manufacturing, Inc., Akron, Ohio, whose workers voted on May 15 not to be represented by the URW. The National Labor Relations Board ordered a new election because of remarks alleged to have been made by D. G. Rempel, president, which the NLRB termed "coercive". Mr. Rempel stated that the NLRB order was "based on fiction rather than fact". Finally, on October 24, Rempel employees again voted not to be represented by the URW.

Construction Program Underway

General Tire and Rubber Co., Akron, Ohio, has announced a multi-million dollar nationwide divisional construction program, which has begun with the completion of an entirely new headquarters building in the company's Philadelphia Division. The two-year, $3,250,000 plan calls for erection of complete new office and warehouse facilities in six out of the twenty General Tire divisions and a $500,000 addition to the company's Brittain warehouse near Akron headquarters. Other divisions affected are Detroit, Boston, Denver, Portland, and Charlotte. Under construction now are facilities at Akron, Denver, Charlotte and Boston, while proposed new office and warehouse installations at Detroit and Portland are in the blueprint stage. The 45,000 square foot Philadelphia Division office and warehouse entailed an expense of $500,000.

Another R/A Milestone

With this issue RUBBER AGE reaches another milestone — the largest issue ever published—206 pages. Readers will find in this issue greatly expanded editorial sections, reflecting not only the growth of our own publication, but the rapid expansion of the industry. It is our firm intention to continue the publication of all worthy material in whatever quantity necessary to assure our readers of complete and thorough coverage.

THE PUBLISHERS

Bucher Joins Falls Engineering

Clarence D. Bucher

Clarence D. Bucher, formerly director of purchases of the Dayton Rubber Co., Dayton, Ohio, has joined the Falls Engineering and Machine Co. of Cuyahoga Falls, Ohio, as western sales and service representative. He will work from Los Angeles, covering a territory that includes California, Arizona, New Mexico, Colorado, Texas, Washington and Oregon. Mr. Bucher's affiliation with Falls Engineering is part of the company's plan to expand its western sales and service facilities to meet the growing requirements in that area. Mr. Bucher, a native of Newark, Ohio, was with the Dayton Rubber Co. for 14 years and with Mohawk Rubber Co. and B. F. Goodrich in Akron for a total of 17 years. He is a graduate of Ohio State University with a degree in mechanical engineering, a registered professional engineer in Ohio and a member of the Engineer's club of Dayton.

Named Assistant General Manager

Ronald R. Menti has been appointed assistant general manager of Latex Fiber Industries, Inc., Beaver Falls, N. Y., a subsidiary of U. S. Rubber Co. Mr. Menti joined U. S. Rubber in 1948 in the Textile Division, where he was engaged in industrial engineering and industrial relations and rose to supervisor of employee relations. In 1953, he was named assistant to the executive vice-president of the company and in 1955, he became operating manager, Eastern hemisphere operations, for the International Division. Mr. Menti has a B. S. degree in mechanical engineering from the University of Maryland and an M. S. degree from Columbia University.

High Polymer Division to Meet

The High Polymer Physics Division of the American Physical Society will hold its seventeenth meeting at the University of Pennsylvania, Philadelphia, Penna., on March 21, 22, 23, jointly with the meeting of the parent Society. The program is being aranged by a committee headed by Dr. Leo Mandelkern, Polymer Structure Section, National Bureau of Standards, Washington 25, D. C.

Names in the News

JEROME KOHL, chief engineer of the Western Division of Tracerlab, Inc. has begun a month long tour of European industrial installations and meetings. During this trip, he will lecture at the Delft Institute of Technology in Holland on "Reactor Instrumentation and Control."

ARTHUR SCHWARTZ, former associate sales promotion director for radio and television at the Bulova Watch Company, has been named sales promotion manager for all products of the International Latex Corp.

H. D. TOMPKINS, vice-president of the Firestone Tire and Rubber Co., Akron, Ohio, has been elected chairman of the Inter-Industry Highway Safety Committee.

DR. H. JOSEPH SHARKEY has been appointed to the research staff of Emery Industries, Inc., Cincinnati, Ohio, where he will be associated with the Organic Research Section.

ED H. GORTON, formerly general sales manager of the Washburn Co., Worcester, Mass., has joined the executive staff of the Wooster Rubber Co., Wooster, Ohio, as assistant to the vice-president in charge of sales.

WILLIAM MCNEIL, formerly associated with Harnischfeger Corp., has been appointed manager of the New York district sales office of Acme-Hamilton Manufacturing Corp., Trenton, N. J.

CHARLES H. EGAN recently retired as vice-president of research of Dewey and Almy Chemical Co., Cambridge, Mass.

L. S. LARSON has been promoted from corporate controller to treasurer of the Standard Products Co., Cleveland, Ohio.

BURTON V. COPLAN, formerly a process design engineer for the M. W. Kellogg Co., has been appointed Silicon Project supervisor at the Chemical Development Department of the General Electric Co., Pittsfield, Mass.

ADRIEN H. ALCAN, manager of the Christopher Trading Corp., has assumed chairmanship of the French Division of the 51st Annual Fund Drive of Travelers Aid Society of New York.

WILLIAM H. CAMPBELL has been appointed manager of dealer sales and HASKELL A. CUNNINGHAM has been named manager of petroleum company tire sales in the Replacement Tire Sales Division of the B. F. Goodrich Co.

DR. HANS K. W. ECKOLDT, who has been in the Patent Department since 1955, has been appointed associate patent counsel for Mobay Chemical Co.

JAMES W. HARLEY, director of traffic of the U. S. Rubber Co., and PERRY ODELL, division purchasing agent, are serving as co-chairmen of the Rubber Division of the 51st Annual Fund Drive of the Travelers Aid Society of New York.

ROSCOE SMITH, director of the Quality Control Office at the Ford Motor Co., was honored by 400 of his co-workers at a special dinner upon completion of his 40th year of service with the company.

DAVID E. TERRY, associated with General Mills, Inc., since 1939, has been named product manager for an expanded line of fatty nitrogen compounds with headquarters in Kankakee, Ill.

DR. ROBERT SAUER, vice-president of the Velsicol Chemical Corp., Chicago, Ill., served as chairman of the American Management Association Workshop seminar held on October 1 to 3 in New York City.

JOSEPH Z. SACK has been appointed to the South Central sales territory of the Fatty Acid Sales Department, Emery Industries, Inc.

FRANK J. OPATRNY, formerly associated with the Perfection Industries Division of the Hupp Corp., has been named assistant sales manager for the Rubber Products Division of the Parker Appliance Co., Cleveland, Ohio.

DON M. ECHNAT, formerly associated with the Rubber Development Co. and the American Hard Rubber Co., has been appointed assistant sales manager of the Colonial Rubber Co., Ravenna, Ohio.

SCHUYLER VAN VECHTEN, vice-president of Lee Higginson Corp., has been elected a director of the Triangle Conduit and Cable Co.

WARREN F. SCHUMACHER, of the J. T. Baker Chemical Co., Phillipsburg, N. J., has been elected chairman of the Nominating Committee of the Salesmen's Association of the American Chemical Industry.

A. C. FUSARO, who has been associated with the Advertising Department since 1950, has been appointed assistant director of advertising of Emery Industries, Inc.

WILLIAM E. SWAN has joined Parker Appliance Co. as sales engineer for O-rings and other molded rubber products, succeeding A. N. "BUD" AIMAN, who has been transferred to Detroit.

JOHN W. F. YOUNG, formerly secretary, has been elected president of the Atlas Package and Container Corp., division of Protective Coating Corp., succeeding LOUIS M. PLANSOEN, who has been named treasurer.

BRICE BOWMAN, formerly associated with the Ohio Bell Telephone Co., has been elected to the board of directors of Rempel Manufacturing, Inc., Akron, Ohio.

A. D. K. AHLBORN has been appointed to the board of directors as assistant managing director of the Avon India Rubber Co., Ltd., Melksham, Wilts., England.

RICHARD J. MARCUS has been elected treasurer of the Boston Woven Hose and Rubber Co., succeeding W. L. LARCING, who has retired. ALDEN S. FOSS, assistant treasurer has been elected a director.

JAMES D. WILSON, formerly associated with Onyx Oil and Chemical Co., has been appointed head of the Plastics and Rubber Laboratories of the Baker Castor Oil Co., New York, N. Y.

JOSEPH H. JUDD, previously associated with the Standard Pressed Steel Co., has been appointed comptroller of the Wellco Shoe Corp. of Waynesville, N. C.

THOMAS E. PARNELL, formerly manager of raw material and auxiliary equipment in the Tire Division of the B. F. Goodrich Co., has been named staff superintendent of the B. F. Goodrich Tire Co.

EUGENE C. PASCHAL, formerly a science teacher in Yellow Springs, Ohio, has joined the staff of the Philadelphia sales office of the Pennsylvania Industrial Chemical Corp., Clairton, Penna.

JOHN D. GANS, previously associated with Continental Can Co., has been appointed merchandising manager of the Wooster Rubber Co., Wooster, Ohio.

J. D. FITZPATRICK has been named manager of the newly created Basic Research Section of Emery Industries, Inc., Cincinnati, Ohio.

F. P. WATT has been named manager of the Accessories and Repair Materials Sales Department of the Seiberling Rubber Co., Akron, Ohio, succeeding E. F. GATES, who died recently.

WILLIAM C. MULLIN has been named sales manager for instrument gages of the Gage Division of the Pratt & Whitney Co., Conn., succeeding ALBERT S. BURGOYNE, who has been named vice-president in charge of manufacturing for the E. W. Bliss Co., Canton, Ohio.

RICHARD W. KIXMILLER, vice-president in charge of the Celanese Chemical Division of the Celanese Corp. of America, has been named director of the company succeeding CHARLES F. BERAN, who has retired after 33 years with the organization.

LYLE B. HAWKINS, previously a senior sales representative in the Cleveland area, has been promoted to technical assistant manager of the New Products Organic Chemicals Department of the Michigan Alkali Division of Wyandotte Chemicals Corp.

Plummer Becomes Consultant

William B. Plummer

William B. Plummer has retired as president of Indoil Chemical Co., subsidiary of Standard Oil Co. (Indiana), to become a private consultant in the petrochemicals field. His headquarters will be located at 1020 Lincoln Building, 60 E. 42nd. St., New York, N. Y. Mr. Plummer had been with Standard Oil Co. and its subsidiaries since 1930. Before World War II, he managed its Development and Patent Department and after his discharge from the Army, he managed the company's Chemical Products Department. When the Indoil Chemical Co. was formed in 1949, he was named president. Mr. Plummer graduated from M. I. T. as a chemical engineer in 1921 and received an M. S. degree in 1922. Until 1930, he was with Combustion Utilities Corp. and was directly involved in the development of Gastex carbon black.

Swaging Machine Patent Awarded

National-Standard Co., Ltd., British subsidiary of National-Standard Co., Niles, Mich., has been awarded a U.S. patent on a swaging machine for joining two ends of wire together in a bond of exceptional strength. The machine is used in the manufacture of high-pressure bicycle tire beads, of the type constructed in England. The machine is a part of a fully automatic manufacturing line in the new Kidderminster, England, plant of National-Standard Co., Ltd., and is capable of producing 600 bicycle tire beads in an hour. This speeds up a critical operation in British bicycle tire manufacture and produces strengthening beads of higher quality, according to John T. D. Spence, managing director of the British plant and co-inventor of the device. National-Standard states that the bead-making machine will be manufactured in the United States if there is sufficient demand for domestic lightweight bicycles with high-pressure tires. American bicycles use low-pressure balloon tires with multiple strand beads that do not impose the forming problems of the British type tires, which are of high pressure, narrow tread design and employ a single strand bead.

Have some comments to make? Write a letter to the editor! (See page 192).

Goodrich Opens Philippine Plant

Goodrich International Rubber Co. of Manilla, an associated company of the B. F. Goodrich Co., Akron, Ohio, formally opened its new tire plant at Marikina, twelve miles from Manila, on October 26. The opening day ceremonies were attended by Philippine President Ramon Magsaysay, Willard C. Gulick, president of the International B. F. Goodrich Co., and other Philippine and American dignitaries. Constructed at a cost of $6,000,000, the new plant, when in full production, will employ about 600 persons and will make a full line of passenger car, truck and bus tires. Plant capacity is about 500 tires a day. Filipinos hold a majority interest in the company. B. F. Goodrich, with a minority interest, is furnishing technical and production management. N. A. Tuason is president of the reorganized Goodrich International Rubber Co. of Manila, which for 28 years has been a subsidiary of B. F. Goodrich selling products made in the United States. Two Americans head the operating personnel. Lewis C. Hayden is executive vice-president and general manager, and John R. Dietrich is plant manager.

SE-751 Oven Door Seal

Silicone Products Department of General Electric Co., Waterford, N. Y., has announced the development of an improved silicone rubber for use in domestic and industrial oven door seals and in other "hot" applications. Designated "SE-751", this low compression set silicone rubber can withstand intermittent temperatures as high as 600°F. Extruded SE-751 gasketing effectively seals in oven heat and odors, may be tinted any color and may be calendered for use in other applications where high temperature performance must be combined with flexibility. A 50-durometer compound in General Electric's Class 700 high temperature silicone rubber series, SE-751 can be made harder by addition of certain diatomaceous fillers. It has excellent processing characteristics for extrusions and calendering, low shrinkage and low water absorption, the company says.

FINANCIAL BRIEFS

William F. Harrah, honorary chairman of the National-Standard Co., has received 2,000 common shares as a stock dividend, and now owns 6,000 shares direct. Walter H. Parkin, chairman, has received 5,300 common shares as a stock dividend and now owns 15,900. Christian F. Sheehle, Jr., vice-president, has acquired 1,500 common shares under a stock option plan and 1,087 shares as a stock dividend and now owns 3,262 shares.

J. W. Keener, executive vice-president of the B. F. Goodrich Co., has purchased 3,226 common shares, increasing his direct holdings to 12,929.

Pyramid Rubber Co. has purchased 2,200 common shares of A. G. Spalding & Bros., Inc., increasing its direct holdings to 91,369.

Gordon Named Production Manager

Harold Gordon

Comar Products Inc., Butler, N. J., has announced that Harold Gordon, former vice-president in charge of production with Martin Rubber Co., Long Branch, N. J., has been named production manager of its Rubber Division.

Opens Butyl Rubber Pilot Plant

A new pilot plant that turns out a ton or more of butyl rubber a day for experimental purposes has gone into service at the Esso Research Laboratories at Baton Rouge, La. The new plant is part of a battery of experimental equipment which includes a smaller, 200-pound-a-day butyl pilot plant, a low-temperature laboratory for fundamental studies of butyl polymers and complete equipment for making finished rubber from the raw product produced by the two pilot plants. The battery of equipment, completed recently, was built at a cost of more than $1,000,000. The ton-a-day pilot plant is being used to test new ideas for improving butyl rubber, to try out entirely new types of rubbers and plastics and to produce relatively large quantities of new butyl compounds for field tests. Test samples shipped out of the Esso Research Laboratories normally are in the form of slabs a foot square and about an inch thick. Also, samples may be diced into tiny pellets. The new pilot unit's refrigeration system is capable of reducing the temperature inside the reactor to 160 degrees below zero. The system produces chilled air in an amount equivalent to the output of 250 household-model room air-conditioners.

Prepares For Hurricane Season

U.S. Rubber Co., New York, N.Y., has announced that nearly $750,000 has been spent in and near the company's six New England plants for flood precautions this year. U.S. Rubber was one of the companies that was hardest hit during the tropical hurricanes that lashed through the northeastern section of the country during the last few years. The company estimates its losses last year at more than $12,000,000 while total losses of all industrial plants in the area came to more than $125,000,000.

2103A Highly Purified Natural

The Plantation Division of the U. S. Rubber Co., New York, N. Y., which, for the last five years, has been producing a highly purified natural rubber, has announced the development of a product of extreme purity consisting substantially of rubber hydrocarbon. This has been accomplished without deterioration of the rubber either by excessive mastication on a mill or excessive chemical or heat treatments. It has been accomplished simply by washing the rubber particles in the latex as they come from the rubber tree a sufficient number of times to remove practically all of the water soluble ingredients. In addition, the nitrogen on the surface of the rubber particles has been displaced during the washing process leaving a surface clean and uncontaminated by water absorbent material such as protein. After the virgin latex particles are washed and the surface layers cleaned of protein, they are spray dried. This means that the rubber has only brief exposure to a heated atmosphere. In addition to this, the company states, a material which protects against copper, manganese, iron, and other such metals has been introduced into the rubber before spray drying. Hence, the resultant rubber not only ages well in storage, but has extra resistance to aging after cure.

Called "2103A Highly Purified Natural Rubber", the actual analyses show that the nitrogen content is .03% or less; the ash is .2% or less, and the acetone extract is in the neighborhood of 3.5%. The extract is almost entirely fatty acid. U. S. Rubber states that this rubber will cure normally in the usual formulas to give excellent physical properties. It is light in color and is uniform from lot to lot. It is said that this material is excellent in the preparation of electrical insulation, rubber hose exposed to high temperatures, and other products requiring extreme resistance to water absorption. This rubber, due to the steps necessary to prepare it, costs more than standard smoked sheet. At the moment, there is a premium of 15c per pound over smoked sheet when purchased in single bales or less. In ton quantities there is a premium of 13c and in five ton quantities a premium of 12c. There is a premium of 11c over smoked sheet on yearly contracts where 20 tons or more of rubber are purchased.

Dow-Corning Silastic LS-53

Dow-Corning Corp., Midland, Mich., has announced a new heat resistant rubber that is said to withstand swelling by aircraft fuels and oils. According to Dr. M. J. Hunter, director of research for the company, the heat resistant rubber, known as "Silastic LS-53", is produced through a process of chemical hybridization combining the silicone rubbers and fluoro-carbon plastics. The Wright Air Development Center collaborated in development of the product. For the present, this new fluoro-silicone rubber will be limited to essential aircraft applications where its properties are most needed as O-rings and other seals where the rubber must perform over a temperature range from 80°F. to over 400°F.

New F-B European Headquarters

Piazza della Republica 32, Milano, Italy, is the address of the newly established office of Farrel-Birmingham Co., Inc. which will handle the sale of products of all the company's divisions and serve customers throughout Europe and the Near East. In charge of this office the company has placed Sergio F. Tomassini, former director and works manager of S. A. Luigi Pomini, Italy, manufacturers of heavy machinery for the rubber, plastics and other industries. Mr. Tomassini recently returned to Europe after an extended visit to the Farrel-Birmingham home office at Ansonia, Conn. During his stay he made a comprehensive study of the products of the company in the Connecticut plants at Ansonia and Derby, the Gear Division at Buffalo, N. Y., the Consolidated Machine Tool Division at Rochester, N. Y., and the Watson-Stillman Press Division at Roselle, N. J. Mr. Tomassini is a doctor of engineering, having received his degree from the University of Rome in 1947.

Mackay Joins Francis Shaw

Dr. J. G. Mackay, formerly works director of the Avon India Rubber Co., Ltd., has joined the board of Francis Shaw and Co., Ltd., Manchester, England, as technical director. Dr. Mackay attended the University of Edinburgh where he received a B. Sc., and proceeded to Dr. of Philosophy. After four years in the laboratory of the North British Rubber Co., Edinburgh, Dr. Mackay joined Avon in 1931 as assistant chief chemist.

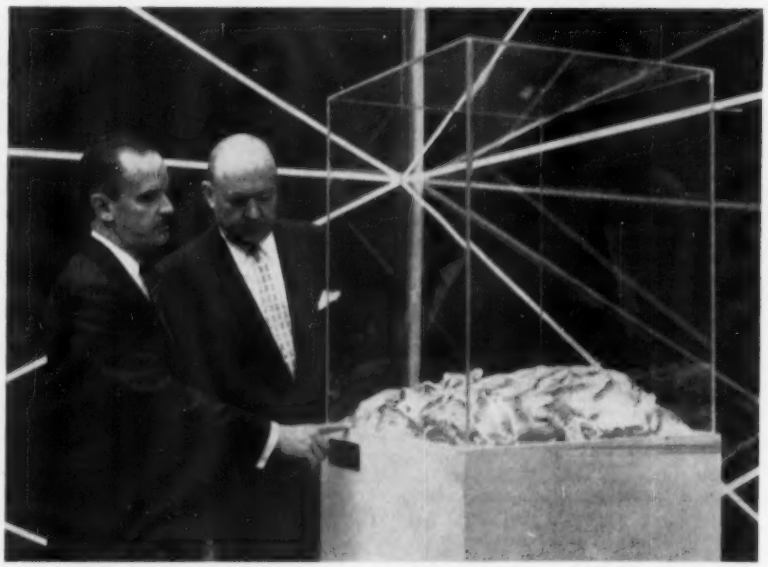
Clevite Harris Expanding

Plans for a major expansion of the Clevite Harris Products plant in Milan, Ohio, have been announced by Matthew J. Fleming, Jr., president. The expansion program will more than double rubber compounding capacity at the plant and provide additional manufacturing area. Key item in the program is a second Banbury mixer, a three-story-high machine in which a wide range of rubber formulas can be compounded. The expansion is scheduled for completion next summer. Clevite Harris produces specially engineered rubber and rubber-and-metal parts. For many years an important supplier to the automotive industry, the company recently has been expanding applications of its products in other industries. The Clevite Harris Milan facility is a rubber molding plant, with much of its production going to the company's plant in Napoleon, Ohio, where rubber-and-metal parts are assembled. However, Mr. Fleming said that precision rubber molding for other industries is a rapidly growing activity, calling for the increase in capacity in the Clevite Harris Milan plant.

Export Director Visits Japan

Witco Chemical Co., New York, N.Y. has announced that Leslie D. Carver, technical service director of the Export Division, is visiting Japan to discuss new developments in rubber technology with all rubber plant personnel in that area. Mr. Carver left the United States on October 28.

INDUSTRIAL RAYON "TYRON" TIRE CORD ON EXHIBIT AT MODERN ART MUSEUM



High tenacity rayon tire cord fabric produced by the Industrial Rayon Corp. at its completely integrated continuous process plants in Painesville and Cleveland, Ohio, is sharing the spotlight this fall at the Museum of Modern Art's spectacular "Textile U.S.A." exhibit in New York City. The tire cord, known as "Tyron", was selected by a jury of noted fabric and fashion designers to be shown with the 189 fashion, decorative and industrial fabrics that make up the exhibit. More than 3,000 fabrics were judged in assembling the show. George I. Rounds, who is in charge of Industrial Rayon's tire rayon sales (left), is shown at the exhibit with William D. Benson, vice-president in charge of sales.

Seeger Joins Diamond Alkali

Dr. N. V. Seeger

Dr. Nelson V. Seeger, formerly associated with the Goodyear Tire & Rubber Co., has been named to the newly created post of associate director of exploratory research for the Diamond Alkali Co., Cleveland, Ohio. Dr. Seeger, in his new position, will hold primary responsibility for the company's development and research activities in monomer, polymer and radiation chemistry. He will be located at the Diamond Research Center in Painesville, Ohio. Dr. Seeger is nationally known for his pioneering chemical research and development work since 1946 in the fast growing urethane plastics field. With Goodyear in 1946, he was appointed group leader on isocyanate chemicals, and four years later was promoted to section head in charge of urethane polymers research and development. In addition to his work in this field, Dr. Seeger also was actively connected with research related to rubber chemicals and polymer-based fiber-forming synthetics designed especially for tire cord use. His efforts in the exploration and development of isocyanate-derived urethane plastics, particularly polymers, are widely recognized. He holds a number of American and foreign patents. Most of these deal with elastomeric high polymers resulting from polyisocyanate modification of polyesters and polyethers. Dr. Seeger attended the University of Michigan, receiving his B.S. degree in chemistry in 1936, his M.S. in 1937 and Ph.D. in organic chemistry in 1940. He is a member of the A.C.S. and is a former officer of the Akron Section.

Brown Elected President

Directors of Petroleum Chemicals, Inc., have elected Bruce K. Brown as president and chief executive officer, the company has announced. Mr. Brown was formerly deputy administrator of the Petroleum Administration for Defense and until recently, president of the Pan-Am Southern Corp. Petroleum Chemicals is owned jointly by the Cities Service Co. and the Continental Oil Co. and has headquarters in New Orleans, La. W. Alton Jones, chairman of Cities Service, and L. F. McCollum, president of Continental Oil, have resigned as chairman and president, respectively, of Petroleum Chemicals.

MCA Education Program

A nationwide education program designed to encourage more of America's youth to follow a career in science has been announced by the Manufacturing Chemists' Association, Washington, D. C. The program for an estimated five-year period will cost about $1,000,000. The MCA science education program has three stated objectives: (1) To inspire qualified students to follow science as a career; (2) To assist educators through the development of science-teaching aids and "curriculum enrichment" of materials, and (3) To aid and encourage science teachers and education administrators toward the goal of increasing their numbers, their effectiveness, and their prestige. During 1956-57, emphasis will be placed on work with junior high schools. Printed materials for both students and teachers plus visual aids will be offered science classes of 3,600 junior high schools during the year. Simultaneously, a pilot program will be conducted at the senior high school level using a demonstration manual, teaching chart, and film strip. On completion of the pilot study the program will be offered to the 11,700 high schools in the United States now teaching chemistry. This will cover an estimated 400,000 students. During 1957-58, the first contact will be made with students in the sixth grade of elementary school. Also included in the program will be a community-level, industry-education, cooperation plan.

General Cable Expanding

General Cable Corp., New York, N. Y., has announced plans to expand the manufacturing facilities of its Tampa, Fla., plant 60% by early 1957. Expansion of the original 50,000 square foot plant, which opened only a few months ago, became necessary sooner than was expected, the company said. The present plant was set up to serve growing communications and electrical industries in the Southeast. The new facilities will be equipped to include manufacture of power cables for electric power companies and many types of electric wire for the building and construction industries. This will permit the Tampa unit to draw its own bare copper wire and completely fabricate aluminum wire, which operations are now being performed in other General Cable plants.

A collision pad made of Goodyear conveyor belt strips fastened together with regular belt fasteners was used to float the S.S.A.M. Byers after it sunk in the St. Clair River, which flows between Lake Erie and Lake Huron.

Gunther Announces Retirement

R. C. Gunther

R. C. Gunther, executive vice-president of the Armstrong Rubber Manufacturing Co., Des Moines, Iowa, has announced his retirement. Mr. Gunther started with the Armstrong Rubber Co., West Haven, Conn., in 1943 as general manager. In 1944, he was transferred to the Des Moines plant, and at the time of his retirement he was general manager of the Armstrong Tire & Rubber Co., Natchez, Miss., as well as Armstrong Rubber Manufacturing at Des Moines. Mr. Gunther spent his entire business career in the rubber industry. He was factory manager for the Mohawk Rubber Co., Akron, Ohio, and the Cooper Tire & Rubber Co., Findlay, Ohio, and eleven years before joining Armstrong Rubber, Mr. Gunther was associated with the Inland Rubber Corp. at Chicago as factory manager and president. Since his retirement, Mr. Gunther has returned to his home in Dayton, Ohio.

Seiberling 14-Inch Tires

Seiberling Rubber Co., Akron, Ohio, has announced that it is producing its complete line of premium-level passenger tires, the Sealed-Aire, Safety and Commuter tires, in 14-inch wheel sizes. This will make the three types available to motorists desiring a changeover from the 14-inch original equipment tires to be found on 1957 automobiles. Seiberling states that their premium-level tires feature characteristics such as puncture-sealing properties, improved winter traction, or greater carcass strength, not incorporated into the 100-level or original equipment tires on new automobiles. These specialty lines are priced from 25 to 95% higher than the 100-level tires.

Damping Bibliography Compiled

A bibliography for the field of damping of materials and structures has been released by the Air Force through the Office of Technical Services. The 105 page volume contains 900 entries covering the period from 1784 to 1955. It is priced at $2.75. The volume, PB 121437, *Bibliography of the Material Damping Field*, L. J. Demer, University of Minnesota for Wright Air Development Center, June 1956, may be ordered from OTS, U. S. Department of Commerce, Washington 25, D. C.

News in Brief

Availability of two grades of phosphorus pentasulfide, one a more highly reactive type having unique properties as an intermediate in reactions, has been announced by Monsanto who has also announced plans for almost doubling production capacity of the material.

The fourth revision of the "Warning Labels," Manual L-1, a guide for the preparation of warning labels for hazardous chemicals, has been published by the Manufacturing Chemists' Association, Inc., 1625 Eye Street, N.W., Washington, D. C. Copies of the 115-page manual are available at $1 each.

Rubba, Inc., New York, N. Y., has announced the development of "No. 994 Rubbatex" adhesive for the manufacture of combination polyethylene and paper bags.

Double Pressed Red Oil (oleic acid) has been added to the line of chemicals produced by the Harwick Standard Chemical Co., Akron, Ohio. Ask for bulletin No. 05-84-0-5-56, for data on the physical characteristics and constituents of this product, as well as some suggested applications.

Interscience Publishers, Inc., New York, N. Y., has inaugurated the "Quality Control and Applied Statistics Abstracts," a monthly loose-leaf abstract service covering the world literature on quality control, operations research and industrial applications of statistical methods of all kinds. Subscription price is $60.00 per volume.

Firestone Plastics Co. and the Foamex Division of the Firestone Products Co. have opened new joint Chicago sales offices at the Merchandise Mart, Suite 950.

A file folder of U.S.I. Polyethylene Processing Tips has been prepared by the U.S. Industrial Chemicals Division, National Distillers Products Corp., 99 Park Avenue, New York, N. Y., and is available upon request.

A. Gross & Co., Newark, N. J., has issued a brochure giving all chemical specifications and the component fatty acid make-up of their complete line of fatty acids.

Hercules Powder Co., Wilmington, Del., has announced plans for an addition to production facilities at its oxychemicals plant at Gibbstown, N. J.

The "Headset Telemuff," companion to the vinyl foam Tele-Muff, has been designed by the Tele-Muff Co., 1421 First Street, San Fernando, Calif., for switchboard operators to relieve ear pressure while shutting out undesirable outside sounds.

Claremont Pigment Dispersion Corp., Roslyn, L. I., N. Y., has developed two new printing series: the "VC" series for gravure vinyl ink concentrates for printing on vinyl film and sheeting; and the "MB" series, a complete ink system for valley printing on treated polyethylene.

A new four-page bulletin has been issued by Climax Molybdenum Co., New York, N. Y., entitled "A Guide to Sources and Applications of Molybdenum Chemicals". Ask for Bulletin Ch-27.

The Textile Division of U. S. Rubber, New York, N. Y., has licensed Collins & Aikman Corp., to produce three-dimensional fabrics coming within U. S. Rubber's patent and patent applications.

A branch office of the National Aniline Division, Allied Chemical & Dye Corp., New York, N. Y., has been opened at 326 South Main St., Akron, Ohio. The Akron telephone number is Blackstone 3-9324.

Harwick Standard Chemical Co., Akron, Ohio, has announced three rubber-to-metal bonding agents. These agents are: "Thixon NB", for vulcanization bonding of neoprene stocks to brass plate or primed metals; "Thixon NM", for vulcanization bonding of neoprene stocks to steel and other metals; and "No. 81238 Oil Resistant Protective Coating".

Parker Appliance Co., Cleveland, Ohio, has appointed the Air-Draulics Co., Pheonix, Arizona, to distribute Parker synthetic rubber O-ring seals.

The City and County of Denver, Colo., has begun a project to install automatic sprinkler systems in its small neighborhood parks. The pipes used for this purpose are made from Bakelite polyethylene.

An illustrated four-page folder describing different methods of feeding antifoam agents to batch and continuous processes is available on request from Hodag Chemical Corp., 7247 North Central Park, Chicago, Ill.

The Eastern sales office of the Chemical-Pigments-Metals Division of the Glidden Co., Baltimore, Md., has moved to 4301 Hawkins Point Road, Baltimore 26, Md. The new telephone number is Curtis 7-6444.

The Petrochemicals Department of American Cyanamid Co., New York, N. Y., has compiled in booklet form a series of 12 illustrated reactions of acrylonitrile.

New type aviation disc brakes, incorporating newly-perfected automatic adjustment, have been developed for the Lockheed Electra by the Goodrich Aviation Products Division.

A complete line of natural and synthetic rubberized products for textile machinery is described in a new 26-page booklet prepared by the Dayton Rubber Co.

Kellogg Chemical Manufacturing Division, M. W. Kellogg Co., Jersey City, N. J., has announced price reductions of Kel-F fluorocarbon plastic molding resins of as much as $2.50 per pound.

Mayer Refrigerating Engineers, Inc., Lincoln Park, N. J., now offer a comprehensive bulletin that thoroughly describes Mayer Model UT-1 and LT-1 Water Economizers. Ask for Bulletin WE-1.

"Pliovic AO Dispersion Resin for Organosols and Plastisols" is the title of a recent Tech-Book Bulletin published by the Chemical Division, Goodyear Tire & Rubber Co., Akron 16, Ohio.

Hamilton Rubber Manufacturing has announced the completion of new warehousing facilities for its South-Atlantic sales territory. The new Atlanta, Ga., warehouse will facilitate area deliveries.

Adhesive Products Corp., New York, N. Y., has announced the development of "Stix-Grip," an improved waterproof and heat resistant contact cement which requires no heating or thinning.

Armstrong Rubber Co., West Haven, Conn., has introduced a new whitewall tire containing Hypalon, which is said to remain white longer than conventional whitewalls and do not develop surface cracks.

The executive, general and sales offices of Advance Solvents & Chemical are now located at 500 Jersey Avenue, New Brunswick, N. J. Telephone: Charter 7-2203.

An eight-page illustrated bulletin on "High Impact Rigid Koroseal Pipe, Fittings and Valves" has been published by Plastic Products, B. F. Goodrich Co., Marietta, Ohio. It is available without charge.

A new folder gives important physical properties and suggested uses for the 36 monomers that are available from Carbide & Carbon Chemicals Co., 30 East 42 Street, New York 17, New York. Ask for monomers Folder F-40033.

Two new technical service bulletins dealing with Witco No. 20 Softener have been made available by the Witco Chemical Co., 122 East 42 Street, New York, N. Y. Bulletin R-11 lists the properties of this compound and describes applications and packing; Bulletin R-12 reports results of laboratory tests to determine relative properties of natural rubber smoked sheet tread stock containing Witco No. 20 versus similar stock compounded with pine tar.

A new two-page bulletin on Maxecon All Purpose, Highflex, Type 50, Commander, and Type 88 air hose has been published by the B. F. Goodrich Industrial Products Co., Akron, Ohio.

Mueller Named Plant Manager

Richard Mueller

Richard Mueller has been named plant manager of the Minnesota Rainbow Rubber Co., Minneapolis, Minn., which recently began operations as the third wholly-owned subsidiary of Minnesota Rubber and Gasket Co., of Minneapolis. Minnesota Rainbow produces a variety of custom-molded products from colored rubber materials. Mr. Mueller was transferred to Minnesota Rainbow from Minnesota Rubber where he was in charge of estimating. He began his career in 1942, when he joined the Wilson Packing Co., forerunner of Minnesota Rubber, serving in several capacities before his transfer to Minnesota Rainbow.

New English Polyethylene Plant

British Hydrocarbon Chemicals, Ltd., jointly owned by the Distillers Co., Ltd., and British Petroleum Co., Ltd., has authorized the design and construction at Grangemouth, Scotland, of a 25,000,000 pound per year polyethylene plant using Phillips Petroleum Company's new process for making polyethylene and other polyolefin plastics. Phillips has licensed its polyolefin process to four major United States chemical companies and six leading overseas firms in as many countries, and is itself constructing a 110,000,000 pound a year plant to produce the new polyethylene at its Adams Terminal chemical manufacturing site on the Houston Ship Channel.

Heyden-Newport Plan Merger

Negotiations are under way for a merger of the Heyden Chemical Corp., New York, N. Y. and Newport Industries, Pensacola, Fla., spokesmen for the Heyden Chemical Corp. have disclosed. Plans are said to call for the combination of the two companies under the name of Heyden-Newport Chemical Corp. The proposal calls for an exchange of common stock on the basis of 1½ shares of Heyden for each share of Newport. It is reported that the companies hope to have the directors act before November 15 and the stockholders before January 1, 1957.

More News in Brief

Goodyear Tire & Rubber Co. has been awarded the bronze "Oscar of Industry" by *Financial World* for having the best annual report of the rubber industry for the fifth year.

At the annual meeting of the board of governors of the Playtex Park Research Institute, it was reported that approximately $1,000,000 has been appropriated for the support of pediatric research by the institute since its establishment in 1950.

Carbide and Carbon Chemicals Co. has issued two technical bulletins. F-40006 describes the properties, shipping data, chemical reactivity and applications of 1,5-Pentanediol, while the other bulletin, (F-7621), describes 2-methyl-5-ethyl pyridine, an intermediate for vinyl pyridines used in the manufacture of certain synthetic fibers and rubbers.

Smooth-On Manufacturing Co., Jersey City, N. J., has released a new booklet describing the applications, physical properties, and methods of mixing "Poly-Flex 100", a new cold-setting flexible mold compound. Ask for Technical Bulletin No. 12.

U. S. Rubber has announced plans to co-sponsor eight of the most important college football games of the reason, and five regional games that will be carried in New England, New York, New Jersey, Pennsylvania and West Virginia, over an N. B. C. nationwide television network of 176 stations.

Diamond Alkali has announced a price increase of 10c to 40c per hundred pounds in less-than-carload prices of soda ash, caustic soda, bicarbonate of soda and modified sodas. The new prices became effective on October 1.

The Industrial Chemical Division of the Commercial Solvents Corp., New York, N. Y., has published a technical data sheet on "Nitroparaffins and Derivatives".

Modern production and industrial uses of carbon black are described by Columbian Carbon in a new 16 mm. film in color with sound entitled "Readin'—Ritin'—Ridin' with Carbon".

A miniature wire rolling mill that flattens and winds a mile of wire every two minutes has been developed by Stanat Manufacturing Co., Inc., Long Island City, N. Y.

Manhattan Rubber has announced that it has completely rubber lined the largest vacuum deaerator ever fabricated. The unit, one of several, is to be used in the country's largest ion exchange water processing system.

Plans to build a West Coast pentaerythritol plant with a production capacity of 10,000,000 pounds a year, plus additional facilities for the annual production of 40,000,000 pounds of formaldehyde, have been announced by the Borden Co.

Frisby Elected Board Chairman

William J. Frisby

The board of directors of the Polson Rubber Co., Garrettsville, Ohio, has elected William J. Frisby as chairman of the board to succeed Harry B. Polson, founder of the company and former board chairman, who died recently. Mr. Frisby will continue as president of the company in addition to being chairman of the board.

Open New Branch Sales Office

Wyrough and Loser, Trenton, N. J., have announced the opening of a new branch sales office at 751 Main St., Waltham, Mass. The telephone number of the new office is Twinbrook 4-7100. William S. Farrell, formerly associated with the General Electric Co., has been named branch manager. The office manager is Miss Norma McDonnell. Mr. Farrell holds a degree in chemical engineering from St. Bonaventure University and has done graduate work at R.P.I. The new office will handle Wyrough and Loser sales and technical service in upper New England. In this area, as well as in the Middle Atlantic States where sales will continue to be handled through the Trenton office, the company is the exclusive agent for Beech-Nut vinyl acetate resins and emulsions, Dayco rubber processing aids, Georgia Marble calcium carbonates, H. M. Johnson chemical driers and surfactants, Sid Richardson Carbon blacks, and Wylox clays.

Solvay Opens New Plant

Solvay Process Division of Allied Chemical and Dye Corp., New York, N. Y., has opened a new hydrogen peroxide plant which uses a new manufacturing process. In contrast with the older electrolytic method of producing hydrogen peroxide, Solvay's new process involves a chemical oxidation reaction and the company believes it to be the most advanced and efficient process developed to date for manufacture of this product. Involving catalytic hydrogenation and subsequent oxidation of complex organic materials, the new process results in the combining of by-product hydrogen from Solvay's adjacent electrolytic chlorine cells, with oxygen from the air, to produce hydrogen peroxide.

OTS Reports On Boron Polymers

A three-part report of an Air Force-sponsored investigation of boron polymers as thermally stable elastomers and plastics has been released through the Office of Technical Services, U. S. Department of Commerce, Washington 25, D.C. The research was part of a broad program to isolate new hydrolytically stable polymeric materials with exceptional fuel and oil resistance and high thermal stability. The report, *Research on Boron Polymers*, describes work by W. L. Ruigh and others at Rutgers University for the Wright Air Development Center. Part 1 (PB 111689, Mar., 1955, 58 pages, $1.50) reviews findings of a three-month survey of literature dealing with inorganic polymers, semi-organic polymers, polymers and rubbers, and the chemistry of boron compounds. Preparation of polymeric boronamides derived from stabilized boronic acids and bifunctional isocyanates was initiated. Part 2 (PB 111892, May, 1955, 85 pages, $2.25) reports the synthesis of quadricovalent chelate and quasi-chelate boronic acids and borates. The diethanolamine ester of benzeneboronic acid was prepared and found to be stable to hydrolysis. Allylboronic acid and its esters were synthesized and studied primarily as intermediates for a dimethylaminopropane boronic acid and related compounds. Part 3 (PB 121374, May, 1956, 47 pages, $1.25) describes a new, simple and efficient synthesis of boron substituted alkyl and aryl borazoles in which an alkyl or aryl boron dichloride is reacted with ammonia. The basic synthesis is said to be applicable to the preparation of boron containing polymers. Benzeneboronic acid, tri-n-butylborine, butylboron dichloride and phenylboron dichloride were studied as intermediates for the new syntheses. A new catalytic recirculating apparatus for preparing phenylboron dichloride from benzene and boron trichloride by Pace's method is also described.

Completes Styrene Expansion

Forth Chemicals, Ltd., London, England, has announced that the major expansion of their styrene monomer plant at Grangemouth, Scotland, has been completed. It is considered that this expansion, which more than trebles the initial capacity of the plant, will make it possible for British industry to satisfy all present needs for styrene monomer without importing from the dollar area. Forth Chemicals announced its intention to double the then capacity of its Grangemouth plant in March, 1954, and in a progress report issued in March, 1955, announced still further expansion to come into operation in 1956. Forth Chemicals was formed in April, 1950, by British Petroleum Chemicals (now British Hydrocarbon Chemicals), and Monsanto Chemicals, Ltd. These two companies own two thirds and one third of the shareholding, respectively. British Hydrocarbon Chemicals is itself jointly owned by the British Petroleum Co., and Distillers Co., Ltd.

Another copy of RUBBER AGE needed in your office? Use the coupon on page 379.

Building New Research Center

U. S. Rubber Co., New York, N. Y., has announced that its new $4,000,000 Research Center, located in Preakness, N. J., entered its final phase of construction on October 17, when the cornerstone was laid in a brief ceremony. The company expects to dedicate the center in the fall of next year. Moving operations from Passaic, N. J., where the central laboratories are now located, will start soon after the first of the year. The new center is built on a heavily wooded 100-acre tract and consists of a central administration building, an experimental laboratory, a chemical engineering laboratory and a greenhouse for growing experimental rubber trees. It will house a staff of approximately 400 scientists and will be the company's headquarters for research in the fields of rubber, plastics, textiles and chemicals.

Polyol Production Unit Underway

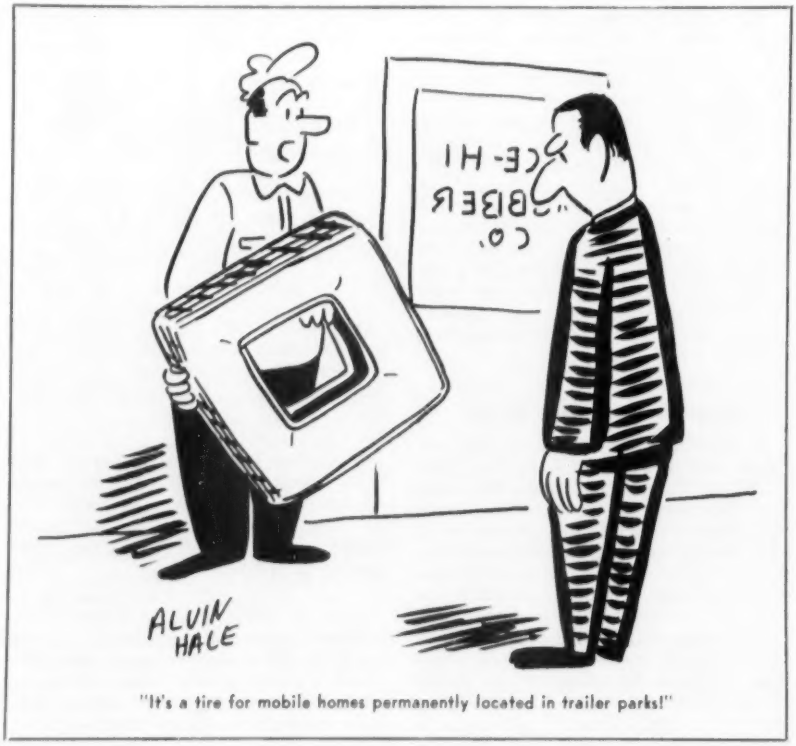
Celanese Corp. of America, New York, N. Y., has started construction of a new polyol production unit at its chemical plant in Bishop, Texas, to meet the increasing demand for trimethylolpropane in the polyurethane plastics and coatings field. The new facility will utilize special aldoling processes developed by Celanese and will greatly expand capacity for polyol and aldol production which began a year ago with the start-up of a semi-works unit. The new commercial unit is expected to be completed and producing by the last quarter of 1957. In addition to providing trimethylolpropane and other intermediates for polyurethane synthesis, the new unit will produce a range of other products that will serve end uses in alkyd resins, high quality brake fluids, and other fields.

Firestone Promotions Announced

Firestone Industrial Products Co., Akron, Ohio, has announced the promotion of B. J. Ferkes to plant manager and E. A. Harper to chief chemist of the Noblesville, Ind., plant. The promotions took place following the appointment of former plant manager, R. D. Smith, to vice-president in charge of manufacturing and development engineering. Mr. Ferkes is a native of Danbury, Conn., attended Indiana Technical College in Fort Wayne and took graduate work at Indiana University, Bloomington. He joined the Firestone Tire and Rubber Co., in 1939 as chief compounder at the Fall River, Mass., industrial products plant and became chief chemist at the Noblesville plant in 1946. Mr. Harper, who succeeds Mr. Ferkes as chief chemist, is a native of Wellston, Ohio, and joined Firestone following graduation from Ohio State University, Columbus, in 1934. In 1935, he joined the new products section of the Mechanical Goods Division which later became the Industrial Products Co. He was transferred to the laboratory at the Fall River plant in 1939 as a chemist, taking a leave of absence from 1942 to 1946 to serve as lieutenant colonel in the U. S. Army Chemical Warfare Service. After his return to the Fall River plant, he served as chief compounder until his recent transfer to the Noblesville plant.

RCA Rubber Sells Bond Issue

RCA Rubber Co., Akron, Ohio, has announced the sale of $125,000 of industrial revenue bonds, the proceeds from the sale to be used for the construction of a plant in Pulaski, Tenn. When in operation, the new plant will be known as the Pulaski Rubber Co. Construction will start shortly.



"It's a tire for mobile homes permanently located in trailer parks!"

Weller Retires From DuPont

Sidney L. Weller

Sidney L. Weller, Chicago district sales representative for the Organic Chemicals Department of E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., has retired after 31 years with the company. Mr. Weller was born in Wrightsville, Penna., and attended Franklin and Marshall College, graduating in 1917 with a bachelor of science degree in chemistry. In 1911 and 1912, he taught in Mann's Choice, Penna., grammar school and Millersville State Normal School, Millersville, Penna. He entered the industrial field in 1919 when he joined the Lee Tire and Rubber Co., Conshohocken, Penna., as a rubber chemist and compounder. In 1925, he began his career with DuPont as a chemist in the rubber laboratory and also handled some sales and demonstration work. He was transferred to the Chicago district as a technical sales representative in 1929 after spending a few months in the Wilmington office as a sales correspondent.

I. T. & T. Buys Royal Electric

International Telephone and Telegraph Corp. has purchased the assets of the Royal Electric Co., Inc., Pawtucket and Woonsocket, R. I., and its subsidiary, the Electric Cords and Supply Co., Inc. of Los Angeles, Calif. Royal Electric, which was founded in 1921 by Joseph and Myer Riesman, manufactures insulated wire and cable, cord sets, wiring devices and fuses which are distributed throughout the United States and Canada. Its sales last year aggregated $15,000,000. The new I. T. & T. acquisition will be operated as a subsidiary.

Philippine Plant Dedicated

Goodyear Tire and Rubber Co., Akron, Ohio, formally dedicated its new tire plant in the Philippines on October 6. Located on a 43-acre site, 12 miles from Manila, the plant is a part of Goodyear's $114,000,000 world-wide expansion program. The first tire cured in the Philippines came out of a plant mold on June 9, 1956, and full production of a complete line of tires, tubes, recapping materials and Neolite and rubber shoe soling slabs and heels, is expected before the end of the year.

Polyurethane Patent Issued

A patent has been issued by the U. S. Patent Office on a basic process for manuafcturing flexible and rigid polyurethane foams and rubbers, according to a recent announcement by R. H. Kittner, development director of Mobay Chemical Co., St. Louis, Mo. The invention covered by the patent provides an injection technique used in the manufacture of urethane products which permits closer quality control of the process as basic chemical ingredients are blended and mixed under pressure, Mr. Kittner said. The technology involved is currently being employed by a group of major American firms which have been licensed by Mobay to use the newly-patented technique, and which are now in commercial production of urethane foams, rubbers and related products.

The patent, No. 2,764,565, was issued on September 25 in the names of Peter Hoppe, Erwin Weinbrenner, Cornelius Mulhhausen and Karl Breer, all associated with Farbenfabriken-Bayer, A. G., of Leverkusen, Germany. Mobay, which has control of the patent in this country, was formed as a joint venture of the Monsanto Chemical Co., of St. Louis and the Bayer firm in 1954 to manufacture isocyanate and polyester resins used in the patented process. The main significance of the patent, Mr. Kittner said, is that it pertains to processing techniques which permit much greater uniformity of texture and cell structure in the manufacture of urethane foams, and closer control of properties in urethane rubbers.

O'Sullivan Dispute Settled

A petition of fifteen stockholders of the O'Sullivan Rubber Corp., Winchester, Va., seeking the call of a special meeting, has been withdrawn bringing the recent management dispute to an apparently amicable close. This group had sought some shifts in the directorate after removal of Vincent A. Catozella as president and board chairman and H. D. Weaver as legal counsel and secretary. After a special board of directors meeting, held on September 28, the company disclosed that Mr. Catozella has been retained as a consultant in connection with the development of new business and that Mr. Weaver's firm had been employed as counsel for the corporation in connection with government affairs.

ASRC Expanding Louisville Plant

American Synthetic Rubber Co. has announced that construction of a $3,000,000 addition to their Louisville, Ky., manufacturing plant has begun. The addition, which is expected to be completed by January, 1957, will increase facilities by 50%, the company states. Three major units will be built: a 10,500 square foot reactor building; a three story, 8,000 square foot recovery building, and a 12,900 square foot finishing building. The latest innovations in synthetic rubber production are being designed into the plant addition, consistent with maintaining production schedules while construction is under way.

Brown Elected Vice-President

James O'Conner Brown

James O'Conner Brown, plant manager of the Petro-Tex Chemical Corp., Houston, Texas, since 1955, has been elected a vice-president of the company. Petro-Tex is jointly owned by the Tennessee Gas Transmission Co. and the Food Machinery and Chemical Corp. Mr. Brown, who has been associated with the Gulf Coast oil industry for over 40 years, first joined the Sinclair Refining Co. as assistant superintendent of the Meraux plant. In 1922, he came to the Houston refinery, as lube oil supervisor. When World War II forced the government to create a synthetic rubber industry, Mr. Brown was selected by Sinclair to assume responsibility for the butadiene plant to be built close to the Houston refinery. Sinclair Rubber Corp. operated this plant for the government until 1955, when it was sold to Petro-Tex.

Acquires Bradley Container

American Can Co., New York, N. Y., has purchased the Bradley Container Corp., Maynard, Mass., producer of extruded plastic tubes and bottles. Bradley Container will be operated as a wholly owned subsidiary under the Bradley name. William C. Stolk, American Can president, will serve as the president of the new subsidiary and L. A. Britzke, American Can general manager of engineering, has been named vice-president and general manager. Bradley Container, formerly a subsidiary of Olin Mathieson Chemical Corp., has been primarily concerned with research and development in the plastics field.

Constructing Cresylic Acid Plant

Pitt-Consul Chemical Co., Newark, N.J., has announced that start-up operations will begin late this year at their new refinery said to be the world's first completely continuous processing plant for cresylic acids, cresols and phenols. Constructed at the company's 48-acre Newark headquarters site, this plant is a major unit of a $3,500,000 plant investment. It is expected that the new refinery will triple Pitt-Consol Chemical's production of cresols, cresylic acids, phenol, phenolic resins and molding powders.

Werkenthin Wins Navy Award

T. A. Werkenthin

Theodore A. Werkenthin, head of the Elastomer Section of the Research and Development Division, Bureau of Ships, U. S. Navy, was presented with the Superior Accomplishment Award on September 27, 1956, for his contributions to the Bureau of Ships elastomer research and development programs. The presentation was made by Captain E. R. Tilburne, director of the Research and Development Division. Of Mr. Werkenthin's contributions, the letter of transmittal said: "His efforts have contributed prominently in the success of the Navy's new ships and equipments that are required to operate under increasingly severe conditions." In 1946, Mr. Werkenthin received the Meritorious Civilian Service award and in 1951, he received the Navy's highest civilian award, the Distinguished Civilian Service award, in recognition of his work on the uses of natural and synthetic rubber. In that same year, he was elected a Fellow of the British Institution of the Rubber Industry. He is one of the nineteen American rubber scientists so honored.

Dayton Forms New Division

Dayton Rubber Co., Dayton, Ohio, has established a new division to provide two-component liquid systems, custom formulated to industry requirements, for the forming of urethane foam materials. As a result, manufacturers now can become their own plastic suppliers. Mixed together, the two liquids form either flexible or rigid urethane foam materials in varying densities, depending upon the formulation. By simply purchasing the two liquids and a suitable mold or molds, manufacturers can form the materials to their own specific needs. No external pressure or heat is required. In addition to supplying the raw materials, Dayton Rubber will make available technical know-how and will assist in solving production problems and in proper utilization of materials for making the end product.

What's going on abroad? Read "Overseas" by Reuter's. (See page 336).

Subscription Service Tire Test

Lawrence R. Sperberg, owner and operator of Three-T-Fleet, Inc., P.O. Box 2923, Odessa, Texas, has announced the inauguration of a new road wear tire testing service. Basically, the service is patterned after the V. L. Smithers Laboratory report on tire construction and analysis, but is devoted exclusively to the road wear testing of the tires themselves. Each test report is copyrighted and the subscriber's final report is completely documented with pictures to illustrate the condition of the tire at the start, middle and end of each test. A distinct feature of the test is that tires of non-participants may be included in each test. Provisions are also available whereby participants may include experimental tires for evaluation along with commercially produced tires. At the present time, the service is restricted to tire manufacturers and to companies who produce brand name tires. However, provisions are being made for suppliers to participate in the service on a basis which will give them all the basic comparisons without disclosure of individual data.

Stein Hall Opens Carolina Plant

Stein Hall and Co., Inc., New York, N.Y., marked the official opening of its newly constructed, $250,000, Charlotte, N.C. plant at special ceremonies on October 6. Situated on a ten-acre site on Glenwood Drive, the structure is part of the company's over-all expansion program designed to meet a growing demand in the South for the firm's textile adhesive and resin manufacture. The new facilities consist of two buildings, one containing the office, laboratories and warehouse and the second devoted to manufacturing operations. They contain 35,000 square feet of indoor space and 5,000 square feet of outdoor process installations, with ample room remaining for future expansion. The plant will produce resins for a number of industrial applications, a variety of formulations for warp sizing, printing, finishing and other steps in textile production as well as Stein Hall's complete line of liquid adhesives.

Nuclear Research Center Opens

Completion of the nation's first, privately owned Nuclear Research Center has been announced by the Battelle Memorial Institute, Columbus, Ohio. The announcement followed initial "start-up" of the Institute's one-million-watt research reactor. The $750,000 reactor is the largest of the "pool type" yet to be put in service in this country. It is designed exclusively for research purposes. It becomes the third major new unit added to the Battelle Nuclear Research Center in the past 13 months. The newly completed reactor uses solid uranium-235 fuel. Battelle's Nuclear Research Center was built in anticipation of the large expansion of nuclear research as a result of the Atomic Energy Act of 1954, which permits private industry to enter upon commercial development of the atom. The Center makes available to industry complete facilities for peacetime nuclear energy studies.

To Head Synthetic Division

A. Robert Rutan, Jr.

A. Robert Rutan, Jr., has been appointed supervisor of the Synthetic Division of the International Packings Corp., Bristol, New Hampshire. Mr. Rutan was formerly manager of the Mechanical Goods Department at the Quaker Rubber Co., Philadelphia, Penna., where, during his nine years service, he also worked as a rubber chemist. Mr. Rutan studied chemical engineering at the Drexel Institute of Technology. During World War II, he served in the European Theatre of Operations with the Radio Intelligence Division of the Signal Corps for two years. He has been active in the Philadelphia Rubber Group and the Boy Scouts of America.

Double-Face Adhesive Film

A new pressure sensitive transfer film for instant adhesion has been developed by Angier Adhesives, Division of Interchemical Corp., Cambridge, Mass. Known as "Double-Face", the new film features a new strength for a pressure sensitive adhesive because of a special tissue reinforcement. It is adaptable to porous and non-porous materials and conforms to irregular surfaces, the company states. Angier's new pressure sensitive adhesive film is supported by a double-coated release paper which can be removed when necessary. Double-Face can be slit or die cut with protective release paper in place. As a pressure-sensitive medium, the company says, it speeds production, reduces waste and eliminates need for drying and coating equipment. The transfer film is available in rolls of 72 linear yards from ½" to 39" wide. There are three types: soft, medium and firm.

To Represent Dutch Firm

Smith Chemical and Color Co., Inc., Brooklyn, N. Y., has been appointed as the exclusive national representative of Magnesiet-En Amaril-Fabrieken of Vlaardingen, Holland, for the sale of magnesite. M. A. F. is the largest and oldest European miner and manufacturer of magnesite and approximately 90% of their production is exported out of Holland and sold through exclusive agents throughout the world.

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Financial News

U. S. Rubber Co.

Nine months to September 30: Net income of $23,453,685, which is equal to $3.61 a share of common stock, compared with $22,290,861, or $3.40 a share of common stock, after deducting hurricane flood losses amounting to $5,090,285 or 94c a share for the first nine months of 1955. The earning figures are based on total shares outstanding after a 2% stock dividend paid last December. Net sales for the nine-month period were $675,147,998 compared with $688,775,620 for the same period last year. U. S. Rubber's capital expenditures during 1957 may be somewhere between $35,000,000 and $40,000,000, compared with $35,282,000 in 1955 and between $30,000,000 and $35,000,000 for 1956. New expansion projects which have been approved, and which will be in the process of construction next year, include a major addition to the company's Kralastic plant at Baton Rouge, La., a new branch for Philadelphia on a seven-acre tract on Rising Sun Avenue and an increase in the butadiene production facilities of Texas-U. S. Chemical Co., Port Neches, Tex.

National Automotive Fibres, Inc.

Nine months to September 30: Net loss of $1,266,269, compared with a net income of $1,567,885 in the first nine months of 1955. The net loss in the 1956 period amounted to $937,695 after tax credits and non-recurring charges. Sales during the nine month period of 1956 totaled $33,752,292, compared with $53,141,066 in the same period of 1955.

Wyandotte Chemicals Corp.

Nine months to September 30: Net income of $3,600,000, which is equal to $2.25 per common share, compared with a loss of $274,266 during the same period in 1955. The company's major productive facilities were strike-bound for 82 days in the first half of 1955. Sales in the nine month period of 1956 totaled $58,900,000.

American Hard Rubber Co.

Thirty-six weeks to September 9: Net income of $739,934, which is equal to $2.10 per common share, compared with $482,505, or $1.28 per common share, in the 36-week period to September 9, 1955. Net sales in the first nine months of the year amounted to $18,459,878, against $14,168,686 in the nine month period of the previous year.

General Tire and Rubber Co.

Nine months to August 31: Net income of $6,059,025, which is equal to $3.66 a common share, compared with $6,874,268, or $4.90 a common share, for the nine month period of 1955. Net sales for the first nine months of this year were $278,192,007, compared with $209,808,056 for the same period last year.

Clevite Corp.

Nine months to September 30: Net income of $2,630,377, which is equal to $1.35 per common share, compared with $3,219,431, or $1.67 per common share, in the same period of 1955. Sales in the nine month period of 1956 were $17,261,690, compared with $16,033,393 in the 1955 nine month period.

Swan Rubber Co.

Year to July 31: Net income of $1,492,903, which is equal to $2.02 per share, compared with $1,154,742, or $1.80 a share for the 1955 fiscal year. Net sales in the year ended July 31, 1956, were $19,715,687 compared with $16,335,498 in the previous fiscal year.

Boston Woven Hose & Rubber Co.

Year to August 31: Net income of $245,000, which is equal to 58c per common share, compared with $287,242, or 71c per common share, in 1955. Net sales in fiscal 1956 were $18,750,000, compared with $16,326,608 in fiscal 1955.

Okonite Company

Nine months to September 30: Net income of $1,208,209, which is equal to $6.24 per share, compared with $1,123,261, or $6.19 a share, in the same period of the previous year.

General Cable Corp.

Nine months to September 30: Net income of $8,725,628, which is equal to $3.06 a share, compared with $4,202,434, or $1.76 for the same period last year.

U. S. Rubber Reclaiming Co.

Nine months to September 30: Net income of $120,850, compared with $270,967 in the same period of the previous year.

AMA Publishes 36th Report

Automobile Manufacturers Association, Detroit, Mich., has published the 36th edition of "Automobile Facts and Figures", the automotive industry's annual statistical handbook. The 80 page book contains tables, charts and pertinent information on the automotive and related industries. Included is a state-by-state breakdown on the Federal-Aid Highway Act of 1956, which says that state highway departments will need $970,000,000 to match Federal appropriations in 1957. Other information to be obtained from the book includes the percentage of automotive retail sales made in this country; the number of motor vehicles produced; consumer preferences; the amount of tax dollars paid on special vehicles and a comparison of the European and American markets.

Introduces Folding Spare Tire

A new "fold-up" spare tire that folds into a package the size of a football, has been announced by the Gates Rubber Co., Denver, Colo. The tire is a part of a kit that contains, in addition, a Gates developed tire puller, used to remove the flat tire from the wheel, and a small cylinder charged with carbon dioxide gas, for inflating the spare. Use of this kit, the company says, facilitates tire changing. After the flat tire is removed, the flexible spare is slipped on and inflated by inserting the

needle on the carbon dioxide cylinder into a special valve on the side of the tire. The cylinder inflates the tire to the proper pressure and when the needle is pulled out, the valve seals itself. The spare can be driven at regular highway speeds, differing in service and performance from a standard tire only in that it is designed for a tread life of approximately 1,000 miles. The spare is reusable and when it is worn out, replacement costs less than a standard tire, Gates states. The model above is shown demonstrating the ease with which the new spare tire can be slipped over a rim.

Develops New Vinyl Gaskets

Goodyear Tire and Rubber Co., Akron, Ohio, has announced the development of low-compression vinyl gasket seals to be used on refrigerator doors. Some months ago, U. S. Congress ruled that future refrigerator doors would have to be manufactured so that they could be opened easily with a slight push from inside. The order was made following a series of children's deaths which occurred when the children accidentally locked themselves in the family refrigerator while at play. In compliance with Congress' ruling, refrigerator manufacturers developed "weak latches" and low pressure magnetic door catches for new model refrigerators. The new type gaskets were designed to be used with this "weak latch" feature and still seal tight instantly.

Wilson Appointed Vice-President

Rubber Corp. of America has announced the promotion of Woodrow F. Wilson to vice-president in charge of the company's Hicksville, N.Y. plant and Raymond J. Abramowitz to research director. Mr. Wilson joined Rubber Corp. in 1948 and has been plant manager since 1953 and Mr. Abramowitz joined the company's research staff in 1945.

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Low Temperature Plasticizer	As Shown
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Parts Low Temperature Plasticizer[1]	22.7	21.0	21.5	20.0
COST				
Pound Volume Cost of Compound	35.7¢	39.4¢	37.2¢	35.8¢
VOLATILITY[2]				
@ 70° C.—Weight Loss %	0.75	0.75	0.92	1.6
@ 90° C.—Weight Loss %	3.6	3.6	3.3	6.0
LOW TEMPERATURE PROPERTIES				
Clash and Berg—Tf[3]	−29.4° C.	−30.5°C.	−29.3°C.	−28.4°C.
Brittleness—SPI Impact[4]				
Passed	−35.0° C.	−35.0°C.	−30.0°C.	−30.0°C.
Failed	−40.0° C.	−40.0°C.	−35.0°C.	−35.0°C.

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Flory Joins Mellon Institute

Dr. Paul J. Flory

Dr. Paul J. Flory, professor of chemistry and acting chairman of the Department of Chemistry at Cornell University, has been chosen executive director of research for the Mellon Institute of Industrial Research, Pittsburgh, Penna. Dr. Flory will join the organization for a day a week this fall, half time in February and full time in the summer of 1957. He will be principally responsible for mapping and guiding the investigational future of the Institute. Dr. Flory has had a distinguished career in research, working with several eminent universities and companies in this capacity. He has pioneered research on the constitution and properties of substances comprised of giant molecules, such as rubbers, plastics, fibers, films and proteins and is the author of 106 papers in scientific journals as well as "Principles of Polymer Chemistry", a highly regarded treatise. Dr. Flory has been issued twenty-two patents, inclusive of instances of co-invention. For his work in his field, Dr. Flory has received several awards, one of which was the Colwyn Medal of the Institution of the Rubber Industry (Great Britain).

Wilson Appointed Plant Manager

Appointment of W. A. Wilson as plant manager of the new Orange, Texas, butadiene plant of the Firestone Tire and Rubber Co. has been announced by A. D. Miller, general manager of the company's Synthetic Rubber and Latex Division. Mr. Wilson was technical manager of Firestone's Lake Charles, Louisiana, synthetic rubber plant for eight years during World War II and during the postwar period. Since 1951, he has worked at the home office in Akron as a special assistant to Mr. Miller on the company's petrochemical program. Mr. Wilson received a bachelor of science degree in chemical engineering from the University of Illinois in 1938. He joined the Firestone company in 1942 and was assigned to the synthetic rubber plant operated by Firestone for the government in Akron.

Firestone Plans New Plant

Firestone Tire and Rubber Co., Akron, Ohio, has announced plans for the immediate construction of a new plant for the increased production of rubber air springs, to be marketed as Firestone "Airide." The proposed plant will be built in Noblesville, Ind., adjacent to the Firestone Industrial Products plant, and will go into volume production in July, 1957. Experiments with Airide bellows for automotive suspension systems to replace the leaf and coil springs now used on some automotive vehicles began in the early 1930's. The system is based on an air compression principle, utilizing a variable volume of air encased like an automobile tire in rubber and nylon to cushion the shocks of the road. They have been used on some trucks and buses for several years and engineers believe they have great possibilities for application to passenger cars in the future. Firestone claims that the incorporation of Airide bellows will permit cars of the future to be constructed lower than any automobile mass-produced so far and that they will be less costly to maintain and repair than steel springs. In addition to its use on trucks, buses and trailers in recent years, Airide has many industrial applications where it is used to cushion machines from shock.

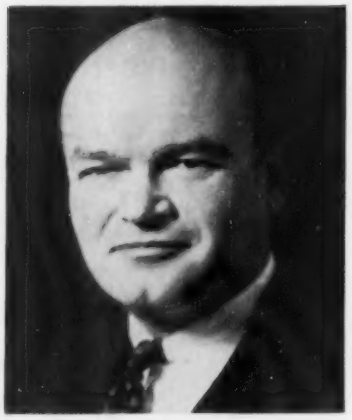
Duolock Bonding System

A new system of bonding rubber to metal has been announced by the Adhesive Division of B. F. Goodrich Industrial Products Co., Akron, Ohio. Called "Duolock", the new system combines a Duolock primer with appropriate Duolock tie coats, and may be used wherever rubber materials, both natural and synthetic, are bonded to metal. Extensive testing of the system has revealed that superior bonds may be obtained over a wide range of curing conditions such as long low temperature cures or short high temperature cures, Goodrich states. The company also announced that its technical service will help firms select exactly the right adhesive to combine with the Duolock primer for dependable results. Usually, its standard tie coats will do the job, although special tie coats can be developed for volume requirements, Goodrich said. Duolock primer is a free flowing, single phase, black liquid supplied at a viscosity of 95 centipoises with a solids content of 22% suitable for brushing as supplied.

U. S. Royal Safety 8 Introduced

U. S. Rubber Co., New York, has introduced a new passenger tire, called the "U. S. Royal Safety 8," which is designed to keep a car steadier on turns and stop it 25% quicker on wet roads. Available in the non-premium price range with nylon or rayon cord, the Safety 8 is being made in 14-inch and 15-inch sizes and in tubeless and tubed constructions. The company believes this to be the best performing tire of its type it has ever built due to innovations in design, rubber compounding, textile processing and chemical bonding. The tire is more resistant to abrasion, stops faster on wet surfaces and has increased resistance to sideway skids, the company says.

Tracy Elected Vice-President



O. V. Tracy

Esso Standard Oil Co., New York, N. Y., has announced the election of O. V. Tracy as vice-president of the company. Mr. Tracy will continue to serve in his capacity as a member of Esso Standard's board of directors, a post he has held since January, 1954. Since May of this year he has also been a member of the company's Executive Committee, with board-level responsibility for both the manufacturing and chemical products departments. Mr. Tracy joined Esso Standard in 1930 and has been associated with the development of synthetic rubbers, alcohols and other chemical products from petroleum. From 1949 until last January, when he was named director, he was general manager of chemical products. On leave from the company in 1951 and 1952, during the war with Korea, he worked with the U. S. Department of Commerce, serving as director of the Chemical Division of the National Production Authority. Mr. Tracy was born in Syracuse, N. Y. and was graduated from the United States Naval Academy in 1924. He is a member of the American Chemical Society.

OTS Issues Elastomer Reports

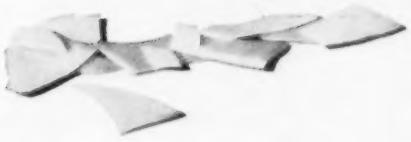
Technical papers presented at the fourth Army-Navy-Air Force Conference on Elastomer Research and Development in January, 1956, have been published and made available to industry through the Office of Technical Services, U. S. Department of Commerce. Sixty-four reports by military researchers describe specific work with elastomers in the general areas of selection and improvement of materials, evaluation of new materials from industry and, in particular, invention and discovery of new materials to meet the needs of extreme operational conditions. The publication, *Elastomer Research and Development*, is available in two volumes: Volume 1, PB 121360, 152 pages, price $2.50; and Volume 2, PB 121361, 314 pages, $5.50. They may be ordered from OTS, U. S. Department of Commerce, Washington 25, D. C.

Interested in foreign developments? Read "Overseas" by Reuter's. (See page 336).

Here's news!

Baker CALCIUM NITRATE, Tech.
ZINC NITRATE, Tech.

in THIN FLAT FLAKES



- *Faster dissolving*
- *Uniform purity—lot after lot*
- *Controlled water of hydration*
- *Easier to handle*

Look over the photograph above, reproduced to actual size. Note the thin flakes with large surface area. THIN FLAKES go into solution FAST – you save time and money. They are easy to handle. These chemicals in *flake* form represent another Baker first.

Latex processors gain better control of coagulation because of the controlled high assay and known water of hydration. This uniform purity, controlled pH and freedom from extraneous matter insure better quality in your finished goods with fewer rejects.

These chemicals are produced to meet precise specifications. In the informative typical analysis shown below, note the very low ammonium nitrate content in Baker Calcium Nitrate. The exceptionally low copper and manganese contribute to longer life for your latex products, with less tendency to oxidize and become brittle or too soft.

These features of Baker Calcium Nitrate and Zinc Nitrate also are helpful to manufacturers of rustproofing specialties, textile finishes, pigments, adhesives and lithographic materials.

Because of the low melting points and deliquescent nature of these chemicals, they are packaged with polyethylene liners and are stored in an air conditioned warehouse at a temperature below 85°F.

Write for samples and prices for these new *flaked* products, Calcium and Zinc Nitrate Technical.

CALCIUM NITRATE, Technical Flake	*Typical analysis*
Assay (as $Ca(NO_3)_2$)	71.8 %
Water of Hydration	27.6 %
Insoluble and NH_4OH Ppt.	0.03 %
Ammonium Nitrate (NH_4NO_3)	0.1 %
Magnesium & Alkalies (as NO_3)	0.4 %
Iron (Fe)	0.0003%
Copper (Cu)	0.0004%
Manganese (Mn)	0.001 %
pH of 5% Solution	6.3
Thin (0.025 in.) flakes about ½ inch in size with the following typical mesh analysis:	
On U.S. No. 4	45%
Thru U.S. No. 20	8%

ZINC NITRATE, Technical Flake	*Typical analysis*
Assay (as $Zn(NO_3)_2$)	74.2 %
Water of Hydration	25.6 %
Insoluble Matter	0.008 %
Iron (Fe)	0.001 %
Lead (Pb)	0.005 %
pH of 5% Solution	5.1
Thin (0.035 in.) flakes about ½ inch in size with the following typical mesh analysis:	
On U.S. No. 4	26%
Thru U.S. No. 20	9%

PURITY BY THE TON
-for production use

J. T. Baker Chemical Co.
REAGENT • CHEMICALS • FINE • INDUSTRIAL
Phillipsburg, New Jersey.

Named Eastern District Manager

Alan W. Bryant

Alan W. Bryant has been appointed eastern district manager in the Sales Department of the Carbon Black and Pigment Division of Columbian Carbon Co. Mr. Bryant's headquarters will be in Columbian's general offices in New York City. Previously, he had been in charge of Columbian's Boston office. Mr. Bryant joined the technical service staff of Binney & Smith Co. following his graduation from Dartmouth College in 1937. In 1942, he joined the Akron sales office of Binney & Smith and in 1946, he opened that company's Boston sales office. He transferred to Columbian Carbon in 1955 when Columbian took over the sale of its products previously handled for it by Binney & Smith. Mr. Bryant is a member of the American Chemical Society, the Rubber Division A. C. S., the Boston Rubber Group (past-chairman) and the Rhode Island Rubber Club.

Fort Wayne Hears Pike

The Fort Wayne Rubber and Plastics Group held its first meeting of the 1956-57 season on September 27 at the Hotel Van Orman in Fort Wayne, Ind. The meeting was attended by 165 members and guests who gathered to hear Sidney J. Pike, Jr. of S. J. Pike & Co., speak on "Conditions in the Far East". Through the use of slides, commentary and background music, Mr. Pike presented a valuable interpretation of conditions in that part of the world. The next-scheduled meeting of the group will be held on December 6 at the Hotel Van Orman.

French Butyl Plant Formed

Ten major French chemical and rubber manufacturers have announced formation of a company to build a butyl rubber plant near Le Havre, France. The plant will have a rated capacity of 20,000 tons of butyl rubber per year and is expected to be in production by the end of 1958. It is reported that the capacity of this first butyl producer outside North America will be sufficient to meet the needs of the French rubber industry and within the next few years there will be a surplus available for export.

Reports on Elastomer Research

Three reports of Air Force-sponsored research on elastomers have become available through the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C. The first report, (PB 121394), is a study of the effect of various initiators or catalysts on the addition reaction involving a single olefin-silane system. The 24 page booklet, *Development of Fluoro-Silicone Elastomers*, Part 2, by P. Tarrant and G. W. Dyckes, Peninsular Chemresearch, Inc. for Wright Air Development Center, was published in May, 1956 and sells for 75c. The second, (PB 121351), discloses the results of a test in which Fluorine-containing elastomers such as FBA were prepared and investigated for possible use in fuels, lubricants and hydraulic fluids over the widest possible temperature range. Entitled *Synthetic Rubbers From Carbon-Fluorine Compounds*, Part 5, by F. A. Bovey, Minnesota Mining and Manufacturing Co. for Wright Air Development Center, the 67 page volume was published in April, 1956 and is priced at $1.75. The final report, (PB 121391), describes an experiment in which cross-linking of polyphosphate chains was attempted as part of a project to prepare an elastomer whose backbone is the polymetaphosphate chain. *Elastomeric Polyphosphates*, Part 2 by R. A. Hubbard, H. and U. P. Straus, Rutgers University for Wright Air Development Center, May, 1956, is a 37 page volume priced at $1.00.

Named Development Manager

U. S. Rubber Co., New York, N. Y., has announced the appointment of Arthur E. Benson, formerly manager of tire design, as development manager of the company's International Division. A graduate of Massachusetts Institute of Technology, Mr. Benson began his career in 1927 as a tire development engineer with the Fisk Rubber Co., now a part of U. S. Rubber. Later he became a special project engineer working on such projects as wire tires and pneumatic tracks for airplane landings on unimproved runways. During the war, Mr. Benson was a major in the Ordnance Department, serving as officer in charge of research and development of small arms, then inspection and gage design, at the Springfield, Mass., armory. He is a member of the American Society of Mechanical Engineers and the American Ordnance Association.

Thorn Retirement Announced

Frederick C. Thorn, research director at the Garlock Packing Co., Palmyra, N.Y., has retired. Mr. Thorn has been affiliated with the American Society for Testing Materials for many years and has been active in the work of Committee D-11 on Rubber and Rubberlike Materials since 1932. He has also served on a number of sub-groups, heading Subcommittee VI on Packings. Mr. Thorn has done a great deal for standardization and the writing of specifications in his field while working with the Society. Committee D-11 recently elected him an honorary member in recognition of his many contributions.

Goodyear Research Promotions

Robert M. Pierson

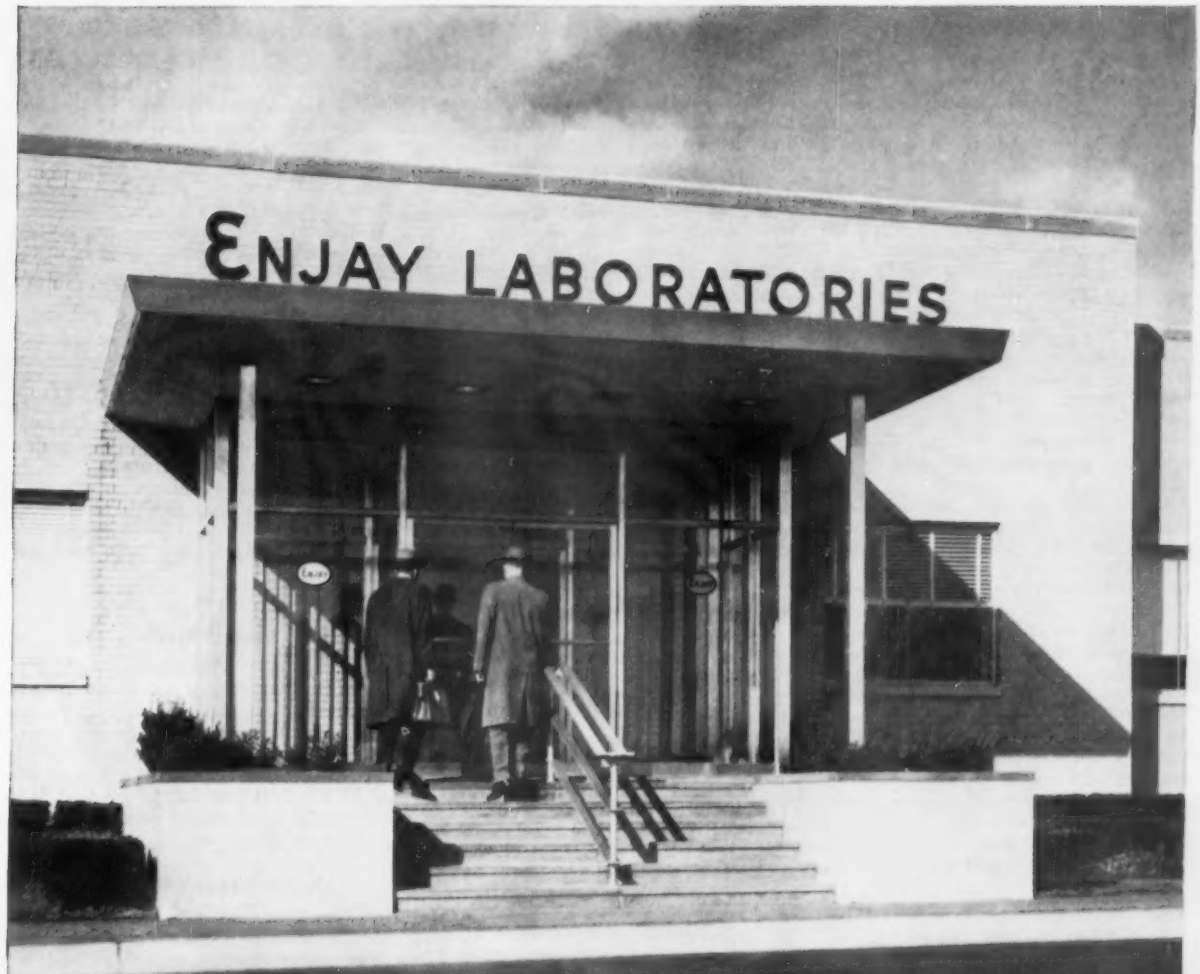
Robert M. Pierson has been appointed a department manager in charge of synthetic rubber research in the Research Division of the Goodyear Tire and Rubber Co., Akron, Ohio. R. W. Hobson, R. H. Mayor and G. E. Meyer have been appointed section heads in this department responsible to Mr. Pierson. Mr. Pierson graduated from Princeton University in 1940 with a B. S. degree in chemical engineering and joined Goodyear in 1941. Dr. Hobson is a graduate of Indiana University and has been a research chemist at Goodyear since 1941. Dr. Mayor graduated from the University of Connecticut, joining Goodyear in 1951. Dr. Meyer received his degree from Johns Hopkins University and became a research chemist at Goodyear in 1953.

Produces 14-Inch Winter Tire

General Tire and Rubber Co., Akron, Ohio, anticipating a greater demand for snow-mud tires, has added to its winter tire line a 14-inch version of its "Winter-Cleat", with variations in design to give advanced styling and performance. Winter-Cleat utilizes 320 sharp-edged, deep cleats on an extra-strong carcass that provides an added safety factor. "Hi-Density" rubber gives the new tire added resistance to cracking from cold and delivers greater wear and softer cushioning, General Tire says. The company notes that consumer demand for winter tires has been edging up since the tires were first produced 19 years ago. Demand is expected to increase more than 10% this year due to the use of 14-inch tires on new cars.

General Tire Buys Lawrence

General Tire and Rubber Co., Akron, Ohio, has announced the acquisition of the Lawrence Process Co., Inc., North Andover, Mass., plastics concern. According to General Tire, the purchase will give the company the advantage of specialized services in the compounding and processing of vinyl resins and polyethylene, and is a further step in the integrated expansion of their plastics operations. General Tire bought Lawrence in exchange for General's $5.00 cumulative preference stock.



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The Enjay Company proudly invites you to inspect the new polymer wing of the Enjay Laboratories, located in Linden, N. J. Continuing the tradition of pioneering in petrochemicals, Enjay has built this new laboratory addition for application research and development exclusively in the polymer division.

With the latest technical equipment and top scientific talent, this new laboratory enables the Enjay Company to give the best possible product application service, as well as furthering Enjay's own product research program.

High speed electronic data processing equipment helps the Enjay scientists solve your compounding problems in record time. In developing new products, or improving old ones, call on Enjay for top-notch assistance. Contact your Enjay representative for further information.

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Enjay Butyl is the super-durable rubber with *outstanding* resistance to aging • abrasion • tear • chipping • cracking • ozone and corona • chemicals • gases • heat • cold • sunlight • moisture.

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Elastopar Butyl Rubber Modifier

Monsanto Chemical Co., St. Louis, Mo., has revealed the development of "Elastopar", said to be the first commercially practical chemical modifier to be developed for butyl rubber. Developed in cooperation with the Esso Research and Engineering Co., Elastopar is an aromatic substituted amine. It is added during compounding at the rate of approximately 1 part per 100 parts of rubber, giving easier mixing and smoother, faster extruding and calendering in addition to improved physical properties. Monsanto states that the production of the all-butyl tire was complicated by the fact that butyl rubber developed too much heat as the tire absorbed road shock. It was found that the butyl polymer could be modified to avoid this heat build-up, but only at the expense of unusually high processing temperatures and long mixing cycles.

At this point, Monsanto undertook a research program to produce a chemical modifier for butyl rubber which would provide all the benefits of long heat treatment, but do this during a normal mixing cycle. The result of this program, "Elastopar", now is being produced in semi-commercial quantities by Monsanto. Supplies are being distributed to the rubber industry for large scale tests. Factory confirmed tests of Elastopar-modified butyl rubber show that the compound approximately doubles the resilience and strength under strain of unmodified butyl rubber and does this in the course of conventional processing steps. Elastopar also is effective, although to a lesser degree, as a modifier of other elastomers, including natural and GR-S type rubbers.

Suburbanite 175 Bicycle Tire

The "Suburbanite 175", a new, blackwall, heavy duty bicycle tire, bearing the same name as the company's all-weather passenger tire, has been introduced by the Goodyear Tire and Rubber Co., Akron, Ohio. Designed for demanding use, the tire has the same type tread, road grip and wearing qualities as the passenger Suburbanite 175. Long angular center and shoulder lugs, wide open lug design, heavily bladed riding ribs and "beefed-up" shoulder bars provide traction on ice, snow, mud and wet pavements. Constructed of a strong carcass fabric with added rubber in the tread, the Suburbanite 175 is built to withstand severe riding conditions, the company says. The tire is available in 26 x 1.75 size.

Nalco Release Agents

National Aluminate Corp., Chicago, Ill., has developed a new kind of release agent which shows promise in rubber and plastic molding. It is odorless, smokeless, noncorrosive and non-toxic. Available in three viscosity-controlled grades, known as "Nalco RA-1", "RA-2" and "RA-3", the product has demonstrated ability to deliver stain-free castings of a highly lustrous and smooth finish and to reduce the proportion of rejects. The RA series may be applied either by spray, automatic injection or brushing.

Natural Rubber Synthesized

The United States Department of Agriculture has announced the successful laboratory synthesis of natural rubber in a new process which compounds enzymes from the rubber plant with a vinegar-like acid. This test-tube rubber is not the same as synthetic rubber made from coal or petroleum. Credited with this first demonstration of rubber synthesis are Dr. H. J. Teas of USDA's Agricultural Research Service and Dr. R. S. Bandurski of Michigan State University. This was the first time that cell-free plant enzymes capable of forming compounds known as isoprenoids, which include rubber, have been separated. The experiments open the way for synthesizing certain compounds chemically akin to rubber that may be of economic importance. Knowledge gained in this laboratory accomplishment might also be used in selecting and breeding improved rubber trees, since the studies yielded valuable information on how rubber trees grow and produce latex.

Goodrich Research Appointments

The Research Center of the B. F. Goodrich Co., Brecksville, Ohio, has announced the appointment of Richard C. Shaver and Roger F. Belt as research chemists and James L. Ginn as a technical man. Mr. Shaver, a native of Akron, attended the University of Cincinnati, graduating in 1950 with a B.S. degree in chemistry. He was formerly associated with the Buxbaum Co., Canton, Ohio, and the Andrews-Alderfer Co., Akron, Ohio. Mr. Belt graduated from the State University of Iowa this spring with a Ph.D. in chemistry. He received his B.S. degree in chemistry at Ohio State University in 1950. Mr. Ginn attended the William Jewell College, Liberty, Mo., graduating in 1951 with an A.B. degree in Physics. In June of this year, he received an M.A. degree in physics from the University of Kansas.

Constructing Pilot Laboratory

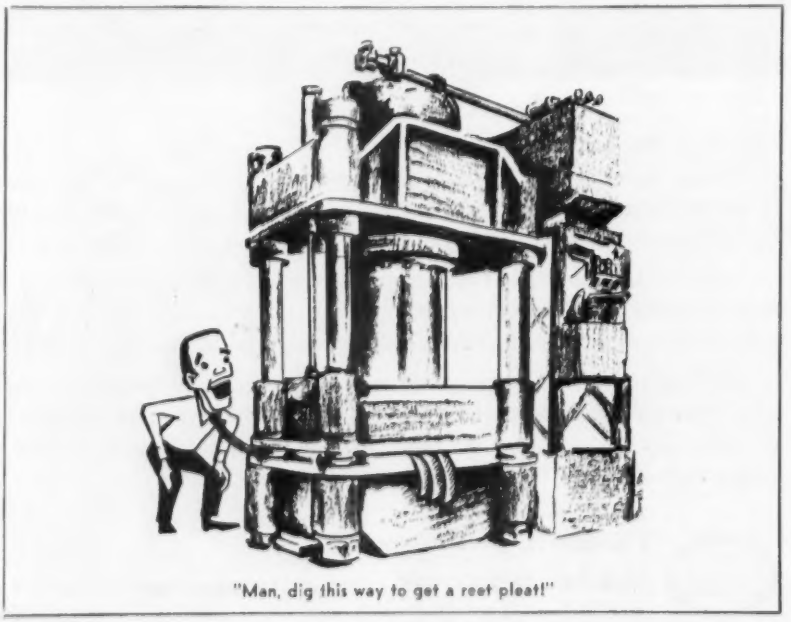
Construction of a new half-million dollar pilot laboratory has been started by the Dewey and Almy Chemical Co., Division of the W. R. Grace & Co., at Cambridge, Mass. The new laboratory will house equipment and facilities for the storage, distillation and purification of monomers as well as coagulation and drying facilities. According to president George Blackwood, the new laboratory will quadruple the area Dewey and Almy presently has devoted to piloting operations. Reactor equipment will range from quart size to 300-gallon capacity, both in glass-lined and stainless steel equipment. Facilities will also be provided for members of the company's central research staff to carry out special tests on runs under investigation. The new laboratory will be equipped for both emulsion and solvent polymerization as well as having a high temperature section for polyester, polyamide and plasticizer research. It will be operated on a 24-hour basis. The new facility is expected to be in operation by February, 1957.

Atlas Mineral Products Sold

Atlas Mineral Products Co. of Mertztown, Penna., has been sold to the Electric Storage Battery Co., Philadelphia., Penna. The acquisition was effected through an exchange of all Atlas Mineral capital stock for 22,500 shares of Electric Storage common. Atlas Mineral will be operated as a subsidiary of Electric Storage Battery.

Captive-Aire in 14-Inch Sizes

The "Captive-Aire" safety tire, the unique tire with the "built-in spare" introduced a few months ago by the Goodyear Tire & Rubber Co., Akron, Ohio, is now being produced in 14-inch sizes. The company is turning out the tires in both 14- and 15-inch sizes.



"Man, dig this way to get a root pleat!"

POLYSAR is used by more than 2,000 manufacturers in 40 countries.

Why?

Because Polysar's quality, uniformity and customer service have enabled these manufacturers to raise product standards, lower production costs and increase plant output. From a wide variety of Polysar types, they can choose the one best suited to their technical needs.

Polysar is available in the following types:

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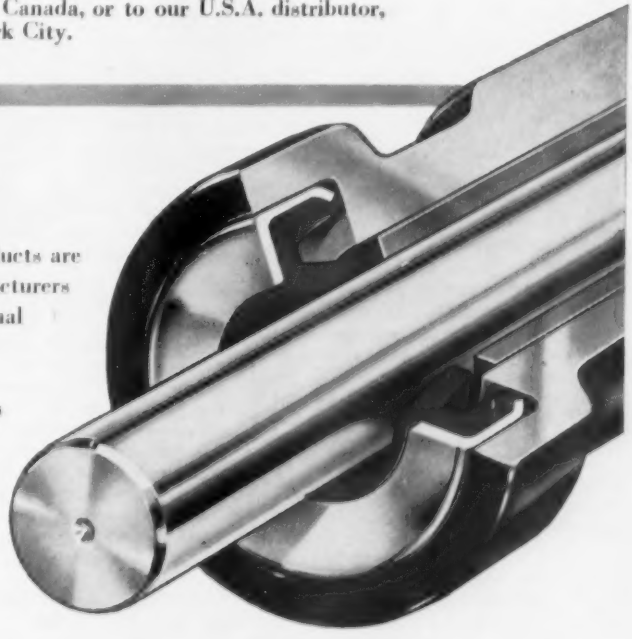
Here's Why POLYSAR Rubber Is Used In Oil Seals

Oil seals and many other oil resistant products are improved by using Polysar Krynac. Manufacturers use Polysar Krynac because of its exceptional scorch resistance; good processing characteristics and physical properties. They know, too, that Polysar Krynac offers the ideal balance of low-temperature properties and oil-resistance.

Polysar rubber has improved oil seals—it can improve your products too.



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West Coast News

Continued rapid expansion of West Coast manufacturing industries over a period of many years has been forecast by J. S. Reid, president of the Standard Products Co., as the firm's West Coast Division opened a new plant quadrupling its production facilities. Standard Products is one of the world's largest manufacturers of automotive window channel and weather strip, and a major producer of more than 80 other products for the automotive and building industries. It opened its first West Coast plant in 1949 at Long Beach, and now has moved to the new plant at Fullerton because its steady increase in business required much larger quarters.

The new plant, at 1550 East Kimberly St., is a modern one-story building with 72,000 square feet of space and is designed for eventual expansion to 108,000 square feet. It has air-conditioned offices opening onto enclosed patios, and the six-acre site is served by a spur of the Santa Fe railroad. Feature of the plant is a continuous flow window channel and weather strip production line designed by the company's central engineering division at Cleveland and described by Mr. Reid as "the most modern and automatic window channel line in the world".

Reassignment of Marshall F. Gillespie and M. S. MacDonald to executive positions at two Goodyear Tire & Rubber Co. plants has been announced. Mr. Gillespie has been named division superintendent at the Los Angeles plant, succeeding Mr. MacDonald who becomes manager of Goodyear's new plant near Glasgow, Scotland. Both men worked together for five years at the Goodyear-Wolverhampton plant in England.

A native of Alderson, W. Va., Mr. Gillespie was graduated from East High School in Akron and attended the University of Akron and Ohio State University. For two years he was manager of the Goodyear plant in Luxemburg and his most recent assignment—for three years—was managing the Goodyear plant in South Africa. Mr. MacDonald, a native of Waterville, Me., was graduated in 1929 from Boston University and in 1933 from the production squadron at Goodyear. Since January, 1955 he has been at the Los Angeles plant.

The Ohio-Apex Division of Food Machinery and Chemical Corp., has relocated and expanded its Los Angeles facilities with Glenn A. Farno, formerly company representative in that area, in charge of the new operation. The new office and warehouse were completed in mid-September and were opened on October 1, at 2121 Yates Ave., Los Angeles 22, Calif. The unit will include a tank farm with ample storage facilities for Ohio-Apex plasticizers and a modern warehouse and office building of 10,000 square feet. Sufficient land was obtained to provide for future expansion. Local representatives of the Becco Division and the Westvaco Mineral Products Division of Food Machinery and Chemical Corp. will be housed at the same location.

A new sales territory to be known as the San Francisco sales district has been created by the Industrial Products Divisions of Hewitt-Robins to handle the company's growing volume of business in the Northwest. Theodore C. Zinter has been named manager of the new district which will embrace the northern half of California, most of Oregon and Washington, and portions of Idaho, Montana and Nevada. Previously the area was served by the company's office in Los Angeles. Mr. Zinter was formerly manager of Hewitt-Robins' belt sales and development department at Buffalo, N. Y. Succeeding Mr. Zinter as manager of belt sales and development is Merrill H. Hickey, who will be headquartered at the company's industrial rubber plant in Buffalo, N. Y.

Stillman Rubber Co., Culver City, Calif., and Cleveland, O., marked its eighth anniversary in October with an expansion program that increased production facilities by 30%. Just completed is an 8000 square foot two-story office and warehouse building adjacent to the company's existing plant at 5811 Marilyn Ave., Culver City, Calif. The upper story houses administrative, accounting and sales offices, while the ground floor is to be used for warehouse area. Completion of the new structure and the company's 8th anniversary will symbolize Stillman's rapid development into one of the nation's largest producers of O-rings and custom molded parts, C. T. Erickson, executive vice-president, said.

California Rubber Products, Inc., Hawthorne, Calif., has purchased the stock owned by minority stockholders. W. E. Shawger is president and general manager of the firm. The company has announced the appointment of Tom Sloan as vice-president and director. James Carpenter has been named factory manager of the Rubber Division, and Don Walters and Fred Bailey have been added to the sales force. California Rubber Products recently broke ground at a new plant site. The moving date is undetermined.

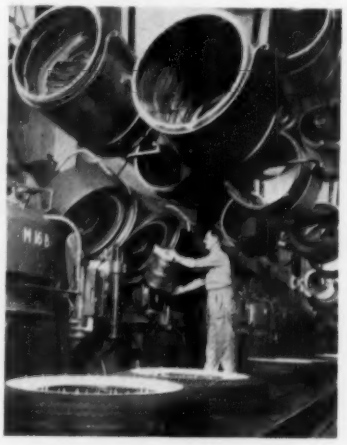
Roy E. Phelan, formerly plant manager of the Atlas Sponge Rubber Co., Monrovia, Calif., has accepted a position with the Boeing Airplane Co. as senior tool engineer.

Mitchell Rubber Products, Inc., Los Angeles, has started construction on a 45,000 square foot plant expansion.

Joe Jones has been named chemist at the Lamb Rubber Corp., Glendale, Calif., succeeding Lee Wilcott.

Increases 14-Inch Tire Output

New facilities have been installed in the plants of the Firestone Tire & Rubber Co. to meet demands from automobile manufacturers for the new 14-inch tire which will be used on many 1957 automobiles. The hand operator shown below is pictured at a Bag-O-Matic line as he places an uncured "green" tire in a mold which shapes and cures the tire in a single, automatic operation. Endless bucket-type conveyors bring the green tires to the operator's fingertips from the floor above. As the molds open, cured tires are removed and placed on the conveyor belt in the foreground and green tires are placed in the mold for shaping and curing.



Harbor Rubber & Plastics Co., Long Beach, Calif., has completed a 5,000 square foot plant expansion program. J. Johnson, owner, reports that the expansion allows for more press line and trimming department space.

Robert Hatch, formerly associated with the W. J. Voit Rubber Corp., has been named purchasing agent for the Cadillac Instrument Co. at Costa Mesa, Calif.

Southwestern Rubber Co., Los Angeles, has announced a modernization of their plant and office facilities.

Industrial Rubber Cement Co., Hawthorne, Calif., plans to increase its facilities to provide new offices and increased manufacturing space.

Ohio-Apex Division of Food Machinery and Chemical Corp. has moved to new offices and warehouse facilities located at 2121 Yates Avenue in Los Angeles.

Dick Way has been named assistant manager of the Industrial Products Division, Shell Oil Co., succeeding Dave Clark who has been named manager of the Commercial Division. Dan Duncan has been appointed to assume the duties formerly handled by Mr. Way.

C. Hart has been named factory manager at the Paramount, Calif., plant of the Midwest Rubber Reclaiming Co.

THE NEXT MEDICAL MILESTONE . . . CONQUEST OF CANCER?

In a few short years we've seen the discovery of antibiotics, new wonder drugs for tuberculosis, a vaccine for polio. We will see the conquest of cancer, too, if people want it badly enough. Last year the American Cancer Society was unable to fill requests for research funds totalling almost $3,000,000. The reason—not enough money. Did you give all you could? Will you give all you can?

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☐ Please send me free information about Cancer.

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Canadian News

Polymer Corp. has donated $25,000 toward the cost of a nuclear reactor to be owned and operated by Hamilton College, McMaster University, Hamilton, Ontario. The existing nuclear reactors in Canada are Government-owned and presently are fully engaged in problems of power development and the peacetime uses of isotope and atomic energy. Any further expansion in the study of atomic energy will require chemists, engineers, physicists and operators trained in the specialized fields of nuclear science. Believing that a university environment is most suitable for training personnel, both industry and government have favorably considered the proposal to install a nuclear reactor at Hamilton College. Polymer Corp., as one of the leading Canadian industries in chemical research work, has a definite interest in new developments and equipment. This contribution to nuclear research and training was given, without reservation, in the general interests of scientific and technological progress in Canada.

Wooster Rubber Co., Ltd., has announced its executive operating staff for a new $500,000 plant nearing completion at Cookeville, Ont. The new plant will produce the company's complete line of Rubbermaid housewares and automotive products. Shannon H. Hoover, who for the past five years has been manager of the company's operations in leased quarters at Port Credit, Ont., has been named vice-president and general manager of the new operations. Wallace D. Sholdice, office manager, has been promoted to the post of assistant secretary-assistant treasurer.

Other officers of the company, a subsidiary of the Wooster Rubber Co., Wooster, Ohio, are James R. Caldwell, president; Forrest B. Shaw, vice-president in charge of the Canadian operations from Wooster; James K. Buckwalter, vice-president in charge of sales; and Donald E. Noble, vice-president, secretary and treasurer. All are officers of the parent company.

Kenneth Byard, formerly works director of Dunlop South Africa, has been appointed vice-president-manufacturing of Dunlop Canada, Ltd., Toronto, Canada. He succeeds W. H. Bartlett, who has been responsible for manufacturing operations since 1932, and who is retiring after 40 years service. Mr. Byard joined the Technical Department, Fort Dunlop, in 1928. His first overseas appointment was to Sahaganj in 1936 where he became assistant technical manager. In 1945, he returned to England and then joined Tyre Process Control Division, Fort Dunlop, as assistant manager, a post he held until he went to Durban as technical manager in 1951. He was appointed works director, Durban, in 1953.

Plans for the construction of a molded rubber goods factory in Edmonton, Alberta, have been announced by W. B. Smith, president of Petroleum Rubber Supplies, Ltd. Mr. Smith said construction of a building to house the factory, offices and warehouse, will begin in the Spring at an approximate cost of $75,000. Installation of equipment will raise the investment to considerably more than $100,000.

Initially, the supply of raw rubber will come from eastern Canada but later it will come from a butyl rubber plant the government is said to plan in Alberta. When the plant is in full production, it will employ 30 to 40 persons, Mr. Smith says.

Kenneth Byard

named vice-president of Dunlop Canada.

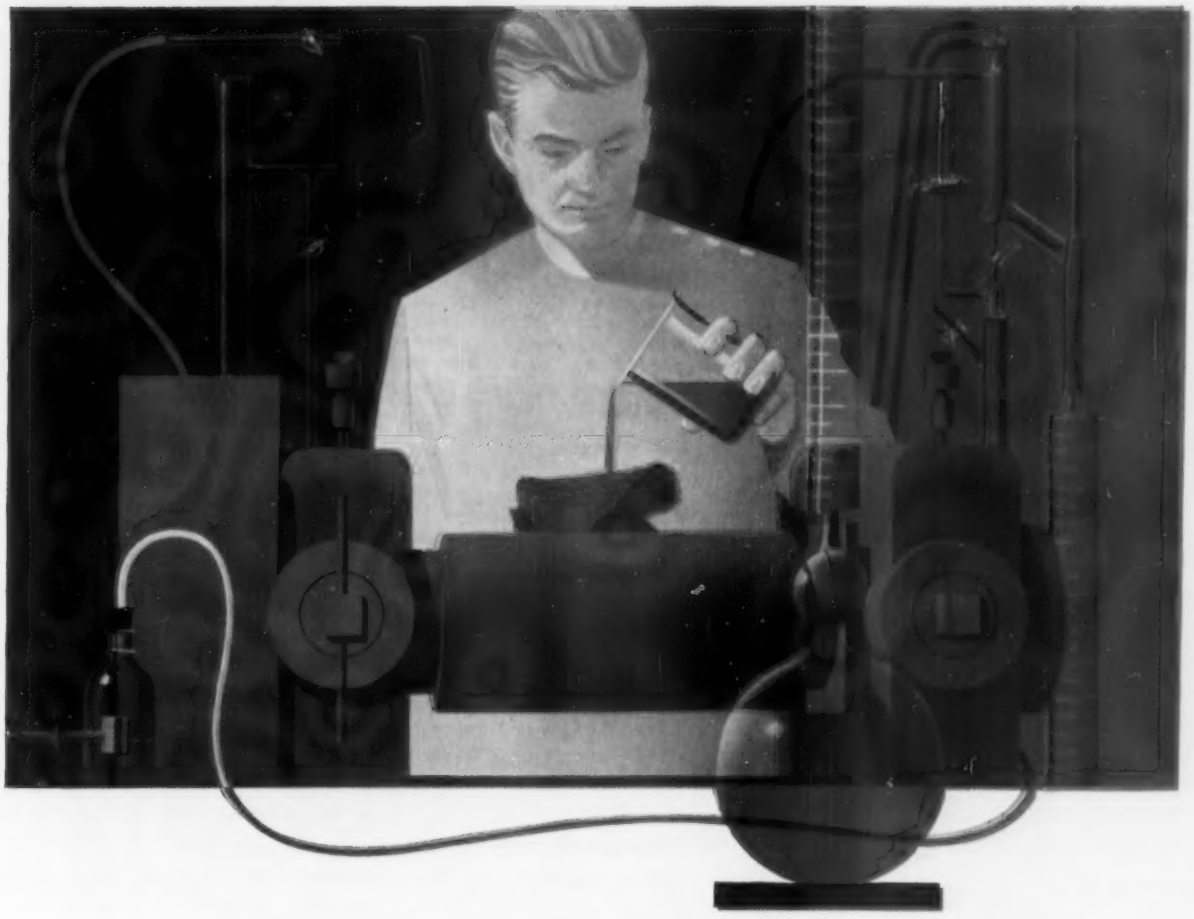
Gutta Percha and Rubber Ltd., Toronto, Canada, subsidiary of Combined Enterprises Ltd., is conducting preliminary studies for the construction of a new factory on its present site. Construction of the new factory, which will be built in several steps, is scheduled to begin sometime after January, 1958. Gutta Percha has spent $1,700,000 on new equipment and processes in the last six years and $250,000 annually for building and equipment maintenance.

Stein Hall, Ltd., Canadian subsidiary of Stein Hall & Co., New York, N. Y., has announced that its Montreal branch is being moved to new and modern quarters which have an extensive laboratory designed to provide technical service for Canadian industry and to engage in product research. Located at 8230 Mayrand Ave., Montreal, the new branch and laboratory quarters were officially opened on September 21.

Goodyear Tire and Rubber Co. of Canada, Ltd., plans to spend $1,200,000 to expand at its Bowmansville, Ont., industrial products plant. Major item is an 84-inch double decked belt press, to be housed in a new brick and steel extension that will add about 15,000 square feet to factory floor space. Tenders are to be called for the building shortly.

Calresin Corp., Los Angeles, Calif., is making a hot-melt compound, to be used as a mold material, known as "Plastifex", which is based on Pliovic vinyl resin.

During the recent C.I.C. Western Regional Conference in Canada, three leading research men took time out for some duck shooting and bagged a total of 36 ducks. Those seen above are Dr. N. H. Grace, director of research, Alberta Research Council, Alberta; Dr. E. J. Buckler, manager of research and development, Polymer Corp., and Dr. N. S. Grace, general manager of the Dunlop Research Center, Toronto.



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Obituaries

Henry Nicholas Ridley

Henry Nicholas Ridley, the "father" of the Malayan rubber industry died on October 24 in London, England, at the age of 100. Mr. Ridley attended Oxford, winning honors in science. In 1880, he joined the Botanic Department of the British Museum, and in 1887 he explored Fernando de Noronha Island, Brazil. The following year he accepted appointment as the first director of Singapore's Botanic Gardens, a post he held until 1912. During this period, Mr. Ridley experimented with rubber trees despite official protests that he was "wasting his time". During his experiments, he planted trees from seeds smuggled into Malaya from the Amazon and, among other things, discovered how to get latex without injuring the tree. After establishing the technique for latex removal, he attempted to interest planters in rubber. His efforts failed until a blight struck the coffee crop and many planters then turned to growing rubber. Another important development credited to Mr. Ridley was the drying of rubber in sheets, rather than in balls.

At the time of his retirement in 1912, Mr. Ridley was named a companion of St. Michael and St. George and was elected a Fellow of the Royal Society. In 1914, he was awarded the Gold Medal of the Rubber Planters Association, and in 1950 was awarded the Frank Meyer Medal for Foreign Plant Introduction and the Linnean Medal. Last year, he was made an Honorary Fellow of the Institution of the Rubber Industry and won the Colwyn Medal. Financially, the only reward Mr. Ridley received for his discoveries was a cash present of £800 from the planters of Malaya on the occasion of his retirement. As a British civil servant, he was prevented from sharing in the fortunes made in rubber.

Last December 10, on his 100th birthday, he received personal congratulations from Queen Elizabeth and the Royal Society. At this time, Singapore also honored him with a week-long salute in gratitude for his introduction of the rubber tree into Malaya. Mr. Ridley continued in botanical research work until five years ago. After his ninetieth birthday he took up the hobby of painting. He did not use a wheel chair until he was 95. Mr. Ridley lost his sight when he was 100, but his mind remained alert and he continued to dictate letters to the many school children who wrote him for information. During his career, Mr. Ridley wrote many books, among them "Botany of Christmas Island" and "Flora of the Malay Peninsula".

"How to Service Tubeless Truck Tires" is the title of a 12-page, self-covered, two-color booklet published by the Rubber Manufacturers Association, 444 Madison Avenue, New York 22, N. Y. Individual copies may be obtained without charge from the Association.

V. R. Jacobs

V. R. Jacobs, since 1936 manager of government sales for the Goodyear Tire and Rubber Co., Akron, Ohio, died on October 20 at Akron General Hospital following an extended illness. He was 60 years old. An authority on lighter-than-aircraft and aeronautics, Mr. Jacobs figured prominently in Goodyear's airship manufacturing activities, dating from the days the company built the U.S.S. Akron and U.S.S. Macon for the U. S. Navy to the present-day range patrol blimps for anti-submarine and aircraft early warning defense service. His knowledge of lighter-than-air activities led to speaking engagements in all parts of the United States. Mr. Jacobs served as assistant sales manager for the former Goodyear Zeppelin Corp. when Akron was known as the "Friedrichshafen of America." During World War II, the post-war period and the Korean conflict, he negotiated many of Goodyear's defense contracts. Born at Grand Rapids, Mich., Mr. Jacobs graduated from Albion College, Mich. He served in the U. S. Navy during the World War I and joined Goodyear in 1920. He is survived by his wife and two sons.

John J. Becker

John J. Becker, resident manager of the Akron, Ohio, office of Paine, Webber, Jackson & Curtis, died on September 26 in City Hospital, Akron, after a long illness. He was 55 years old. Born in Brooklyn, N. Y., Mr. Becker lived in Colombo, Ceylon from 1922 to 1928 where he served as a managing director of a rubber exporting firm. In 1928, he became a rubber importer in New York and in the same year, he went to Akron to become a rubber broker. From 1941 to 1946, he was resident agent of the Rubber Development Corp. in Panama, in charge of procuring wild rubber for America's war needs. He returned to the brokerage firm in 1947. A widely known rubber expert, Mr. Becker was again given leave of absence to serve as a special consultant to the Rubber Division of the General Services Administration in Washington to help in the rubber stockpiling program. He became manager of Paine, Webber, Jackson & Curtis in 1953. Mr. Becker is survived by his wife and daughter.

MacNeel Pierce

MacNeel Pierce, founder and president of Plastic and Rubber Products Co., Los Angeles, Calif., died on September 25 in Los Angeles, Calif. Mr. Pierce was a dominant figure in the rubber industry on the West Coast having spent all of his business life in this industry. He was an executive with Kirkhill Rubber Co., Downey, Calif., before forming his own company in 1941.

700,000,000th Goodyear Tire

The 700,000,000th pneumatic tire to be produced by the Goodyear Tire & Rubber Co. has rolled off production lines at Akron, Ohio, establishing what is said to be a new world's record for the number of tires built by a single firm. The milestone unit was a "Captive-Air" safety tire, Goodyear's dual-compartment tire which was introduced in June. The tire will be placed in the company's rubber exhibit along with other significant Goodyear tires. According to Goodyear, the Captive-Air safety tire is the ultimate in safety. Should the two-in-one tire be ripped open by a blowout, the motorist can keep driving safely at normal speeds for 100 miles or more before stopping, the company says. When there is a blowout or puncture, only the air in the outer chamber escapes. The car is supported by the "captive-air" in the inner tire. In addition to its original equipment usage, the Captive-Air safety tire is being marketed by Goodyear on a nationwide basis.

Producing Plastic Heel Bases

The Windsor, Vt., plant of the Goodyear Tire and Rubber Co., has started production of polyethylene plastic heel bases. Full production on a complete line of plastic heel bases for men's, children's and some women's shoes is expected sometime early next year. Named "Jetlite", the new product is manufactured by the injection molding process. The company reports that the economical heel base is lighter and takes a better finish than other types. The plastic material will not absorb moisture nor distort in use, according to the company.

Ernest B. Caldwell

Ernest B. Caldwell, rubber technologist at the Rubber Laboratory, Mare Island Naval Shipyard, Vallejo, Calif., died on August 3 after an extended illness. He was 46 years old. Mr. Caldwell received his B.S. from Cornell College, Iowa, and started his career with the Goodyear Tire and Rubber Co. in Los Angeles, Calif. He later worked as rubber technologist with the E. M. Smith Co. of that city and then with the Gates Rubber Co. He was a member of several civic organizations and of the American Chemical Society. Surviving are his wife and son.

Larry D. Snow

Larry D. Snow, secretary and sales manager of the Fullerton Manufacturing Co., Fullerton, Calif., died of a heart attack in Santa Ana, Calif., on October 10. He was 38 years old. An active civic leader, Mr. Snow was a director of the Fullerton Rotary Club, president of the Orange County Shrine Club and president of the Anaheim Area Industrial Group. He was also active in YMCA and Boy Scout work, was past master of the San Clemente Masonic Lodge and was a member of First Methodist Church. He is survived by his wife and four children.

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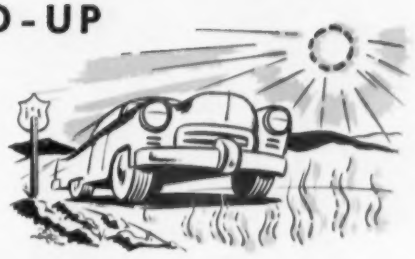

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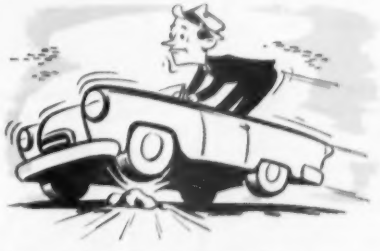
Circosol-2XH will give you tougher, more resilient rubber needed to make safer tires. Tests show that tires made with Circosol-2XH can take more impacts and a rougher all around beating than tires made with softeners of different composition.



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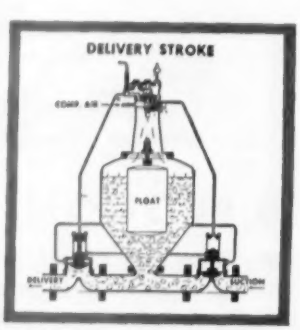

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Overseas
by Reuter's

Tokyo—The Japanese rubber industry has continued to increase production of rubber goods this year to meet rising requirements of both domestic and overseas consumers. The active demand upon the industry is caused by the rise in requirements for rubber products including automobile tires and tubes, belts, hose and rubber goods for industrial uses. Another reason for the prosperity of the industry is increased exports, mainly to Southeast Asian countries.

Japan's imports of natural rubber in the first eight months of this year amounted to 66,875 tons, compared with 58,229 tons during the first eight months of the preceding year. Imports of natural rubber in July hit a post-war high, totalling 11,147 tons. At the present time, Japan's natural rubber requirements are covered by imports, in the main, from Malaya and Indonesia.

Meanwhile, three Japanese chemical industrial groups are studying a suggestion from the Ministry of Trade that they merge forces to start synthetic rubber production. The groups had submitted to the Ministry plans for building separate plants, the production of which would amount to 15,000 tons each by 1960. The Ministry, however, expressed doubts whether such small plants, operating independently, could be run on a paying basis. The Ministry pointed out that synthetic rubber industries in the U.S., U.K., West Germany and Italy were on a much larger scale.

The Japan Rubber Manufacturers Association, in a recent report, has increased its estimate of Japanese synthetic rubber requirements in 1960 to 46,000 tons. Only last year, the Association estimated 1960 requirements at 20,000 tons. The revision had been made, the Association explained, because it is now clear that Japanese consumers would accept more synthetic rubber. The Association said it was opposed to a plan reportedly being considered by the Ministry of Trade for imposing import duties on synthetic rubber to protect the projected synthetic rubber plants. It added, however, that consumers would welcome other forms of assistance from the government, such as low interest loans, tax relief and depreciation benefits.

—•—

Peking—China's present purchases of rubber are only an "infinitesimal part" of what is needed from Malaya, according to the Chinese Minister of Foreign Trade. He said China would endeavor, as far as was practical, to buy more from Singapore to equal the balance of trade now heavily in China's favor.

—•—

Ibadan—Nigeria could challenge Malaya's world supremacy in rubber production if sufficient effort were made, English authorities state. Some English plantation companies are already reported to be examining the situation with an eye to the establishment of a Nigerian plantation industry.

—•—

Djakarta—The recent threatened strike by 400,000 rubber estate workers throughout Indonesia has been averted following a Labour Mediation Board ruling that workers should receive a half-month's salary as a bonus. The workers' union had claimed a bonus for 1955.

They thought it was alive

When Columbus and his sailors visited South America, they saw Indians playing with balls that bounced with such resilience the startled Europeans thought they were alive.

Those strange jumping balls, of course, were rubber. But rubber is no longer a plaything. It's so essential that rubber plantations—American style—have sprouted up throughout the country. One of the largest and best equipped of these domestic rubber plantations flourishes at Torrance, California, where Shell Chemical produces a full line of S-type copolymers to fill the needs of large and small Western manufacturers. You'll find that Shell synthetic rubber, available in a variety of solid types and liquid latices, can do a better job for you.

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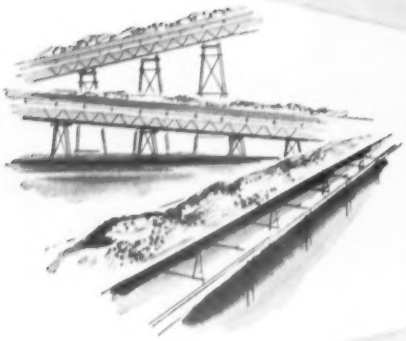
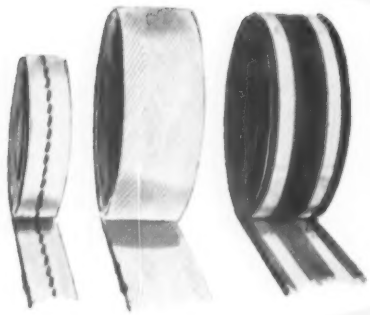
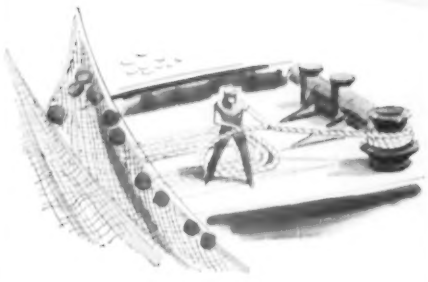


Conveyor Belts



Webbing



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Caprolan *tensile-tough* nylon heavy yarns (2000 denier and up) are a completely new yarn class that assures unusual durability and economical performance in such industrial products as duck, webbing, rope and similar constructions.

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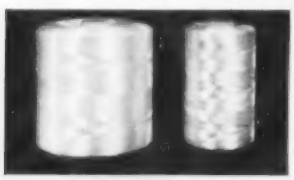

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We are duly thankful for the business which you have given us and trust that we have continued to maintain the high standards of service to which we aspire. It is our desire, also, that all your dealings with us have been to your entire satisfaction. Our constant aim is to merit your confidence and good will.

With best wishes for your enduring success and prosperity, we remain

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AO or AO-X					X	X	X		X			
AR or AR-F			X		X							
BF or BG-X	X	X	X		X	X	X					
BGM or BGM-X	X	X		X		X						
CY					X				X			
DJ	X	X	X				X		X			
DL							X		X			
H			X		X			X	X	X	X	
LD	X	X	X	X	X	X		X				
ND or ND-X	X	X	X	X	X	X	X	X	X	X	X	
O	X	X	X	X		X	X		X	X	X	X
OS or OS-X	X	X	X	X			X					

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OVERSEAS (CONT'D)

London—The directors of Dunlop Rubber have announced that the trading results of the Dunlop Group during the first six months of 1956 have been adversely affected by various factors, the principal factor being the price movements of natural rubber. In consequence, the Group has suffered substantial inventory losses in the first half of 1956. Costs and margins have also been adversely affected by higher labor rates as compared with last year.

There is also a lower volume of production and sales arising from the reduced demand from certain industries which the Group serves in the United Kingdom, in particular the vehicle, cycle and furniture manufacturing industries. Trading conditions in some overseas countries in which the Group operates have so far in 1956 been less satisfactory than in 1955. While conditions continue to be difficult, it is anticipated that the results for the second half of 1956 will show improvement.

—•—

Kuala Lumpur—Rubber exports to the Chinese Republic will only be permitted if Malayan exporters guarantee that the rubber is for civilian use only, the Malayan Minister of Commerce has declared. He said that exporters should attempt to get a certificate from the import agency in China providing the guarantee. He disclosed that the Malayan Government has means of calculating the amount of rubber China could use for civilian purposes.

—•—

London—British Geon, Ltd., has announced plans for the manufacture of synthetic rubber at a new plant now being erected at Barry, in Glamorganshire. The plant will manufacture nitrile rubbers. News of the venture was announced by Distillers Co., Ltd. British Geon is one of the three companies comprising the Distillers plastics group.

—•—

Geneva—Ceylon's Commerce Minister has appealed to member nations of the General Agreement on Tariffs and Trade to try and reach an agreement on methods to promote stable prices for raw materials supplied by the under-developed countries of the world. He warned that failure to achieve stable commodity prices would have political as well as commercial repercussions. The Minister cited Ceylon's rubber-price pact with China as an example of the importance placed by under-developed countries on benefits of price stabilization. Under this pact, he said, Ceylon was assured of stable rubber prices for five years and planters had been able to go ahead with development plans.

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Malacca—A prominent Chinese rubber dealer has stated that the Malayan Government's protest to Great Britain over her intention to allow British manufacturers to import more synthetic rubber next year from the United States was "bound to go into the waste paper basket". The dealer observed that "America is out to smash the natural rubber industry of Malaya" and added: "It is time we in Malaya took note of the situation." The dealer complained that the Federation Government was doing little to improve the natural rubber industry. Replanting has proved a failure, he said, and Malaya would have to produce more rubber at cheaper prices to compete with synthetic.

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PRESSURE SENSITIVE

Plasticizes • Stabilizes • Extends

Aids Molding and Extrusion of

Natural and Synthetic Rubbers

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Properties

Natural State	Powder
Color	Amber
Specific Gravity	1.11
Melting Point	Pressure Sensitive
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Process Oil	5
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Zinc Oxide	15
Whiting (Water Ground)	50
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OVERSEAS (CONT'D)

Tel Aviv—Israel's two tire factories have received orders from Poland and Turkey worth $2,350,000. Poland will take $1,100,000 worth within the framework of an agreement recently signed between the two countries. Orders totaling $1,250,000 have been received from Turkey and these tires will be supplied in 1957.

— • —

New Delhi—Proposals are now being studied for the construction of a synthetic rubber plant in India. Current plans call for the production of alcohol-butadiene from molasses. It is expected that synthetic rubber produced in this way will be cheaper by about 4c per pound than natural rubber.

— • —

Vienna—An increase of liberalization of imports from the dollar area has been agreed upon by the Austrian Cabinet. Among the products which fall under the new liberalization order are automobile tires of 100 kilogram weight, various chemical products and gutta percha.

— • —

Colombo—Ceylon exported 341,015 pounds of sole crepe rubber during August, compared with 197,824 pounds in July. Commonwealth purchases accounted for 82,035 pounds of the total. Total exports of crepe rubber in the first eight months of this year amounted to 2,163,324 pounds. Ceylon also exported 4,294,506 pounds of sheet rubber during August, against 22,398,930 pounds in July.

— • —

Paris—Societe du Caoutchouc Butyl (SOCABU), the French company which is to produce synthetic rubber at Port Jerome, near Le Havre, has signed a contract with an American company for the construction of its plant. SOCABU was formed by leading French oil, chemical and rubber companies to make France self-sufficient in synthetic rubber presently imported.

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Bangkok—There is said to be a great deal of foreign interest in industrial investments in Thailand. The Ministry of Industry reports that an Italian firm is thinking of setting up a bicycle tire factory in the country. Thailand uses an estimated 50,000 tires per year.

— • —

Singapore—An official of the Singapore Rubber Packers Association has disclosed that many packers are considering closing their businesses because of "uncooperative" and "go-slow" tactics by some of their workers. It is stated that if the labor situation does not improve before the end of this year, several members of the Association are definitely stopping business.

— • —

London—The carrying of rubber life rafts on certain types of fishing boats has been made compulsory from October 1, 1956, according to the Ministry of Transport. After intensive research into the performance and capabilities of the rafts, the Ministry is convinced of their usefulness.

— • —

Colombo—The Upper House of the Ceylon Parliament has rejected a bill passed by the House of Representatives on October 24 to bring rubber estates within the scope of the Food Production Act. The bill would compel estate owners to grow food crops on a certain percentage of their acreage ranging from 6 to 12%.

THE Thiokol® RUBBER REPORTER

Solvent-Resistant Paint Spray Hose Based on "THIOKOL" Synthetic Rubber

ORDINARY RUBBER-COMPOSITION LINER after laboratory tests for solvent resistance shows deterioration caused by action of common paint thinners.

"THIOKOL" SYNTHETIC RUBBER-COMPOUNDED LINER, manufactured by DeVilbiss Co., Toledo, Ohio, shows no deterioration after being subjected to identical solvent action.

PROTECTS AGAINST SWELLING, PLUGGING, PAINT DISCOLORATION AND CONTAMINATION

Hose linings compounded with "Thiokol" Synthetic Rubber Type FA display outstanding resistance to the deteriorating effects of lacquer, paint thinners, aromatic fuels and a wide range of other solvents.

"Thiokol" synthetic rubbers are tough and resilient polymers. When compounded and vulcanized, they display exceptional resistance to most aliphatic and aromatic solvents. They are highly impermeable to gases, moisture and liquids.

"Thiokol" synthetic rubbers are unaffected by aging, weathering, ozone and sunlight, and have a service temperature range of −60°F to +250°F. They can easily be fabricated into many shapes by extruding, molding and calendering, and may be compounded into permanent, non-volatile putties.

For additional information and samples, write: THIOKOL CHEMICAL CORPORATION, 784 NORTH CLINTON AVE., TRENTON 7, N. J. In Canada: Naugatuck Chemicals Division, Dominion Rubber Company, Elmira, Ontario.

"Thiokol" Synthetic Rubbers Provide:

- resistance to solvents and oils
- low temperature flexibility
- resistance to sunlight, ozone and aging
- impermeability to gases, moisture and liquids

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IN TEST RESULTS

is greatly increased by positive control of specimen temperatures

in the Model DMC

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A constant volume of air at a controlled temperature in the heavily insulated cabinet, maintains uniform predetermined specimen temperatures regardless of variations in room conditions.

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All automatic controls are located on the front panel of the Weather-Ometer directly above the door of the test chamber.

Both horizontal and vertical testing is available. Shallow containers are used for semi-liquid materials and vertical panels for solid materials.

Source of radiation is two Atlas enclosed violet carbon arcs.

Complete technical information on the DMC Model and other Weather-Ometers is contained in the new Weather-Ometer catalog. Copy on request.

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The Atlas Fade-Ometer has world-wide acceptance as the standard machine for testing the action of sunlight on materials.

A wide range of industrial products are tested daily in Atlas Fade-Ometers to determine the deterioration of materials due to the action of sunlight.

From 21 to 126 samples, depending on size, can be simultaneously exposed to the light of the Atlas Enclosed Carbon Arc. Temperature is controlled automatically and humidity is furnished by evaporation from a constant water reservoir. Operation of the Fade-Ometer is completely automatic, permitting the machine to be left in continuous 24-hour operation.

The Carbon Arc Lamp in the Fade-Ometer is the closest known duplicate of sunlight, both as to intensity and spectral distribution.

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Catalog with technical information on request

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New Goods

Hi-Top Work Rubber

A new line of lightweight molded rubbers, produced by the Tingley Rubber Corp., 903 Ross St., Rahway, N. J., are specifically designed to be worn over heavy workshoes. Available in four sizes, the rubbers stretch to fit any workshoe, have an extra high top for added protection and are easy to keep clean because of their one piece molded construction which eliminates the usual fabric

lining. They are available in a choice of two elastomers: regular for ordinary wet-wear service; and neoprene for service involving contact with chemicals. Colors are black, safety yellow or black with yellow strip molded in toe. The soles are finished in a diamond grid pattern. The rubbers are available under the trade name of "Hi-Top Work Rubber."

"Nyfil 120-RS" Belt Fabric

A conveyor belt made with five plies of the new "Nyfil 120-RS" fabric, which is claimed to be as strong as a steel cord belt rated at 1,000 pounds per inch per ply, is being constructed by the B. F. Goodrich Industrial Products Co., Akron, Ohio. This is the latest addition to the company's line of nylon-filled conveyor and elevator belt fabrics. Nyfil 120-RS is a combination of super strength rayon with nylon filler which permits belt operating tensions up to 200 pounds per inch per ply width, the company reports. Advantages of longer single flights of belt made possible by the new 120-RS construction, according to the company, include elimination of transfer points, reduced installation and maintenance costs and longer belt life, since loads on longer belts are deposited less frequently at any given point on the belt. Belts made with nylon filler have exceptional flexibility for better troughing and resistance to impact, the company states. High strength nylon provides greater crosswise strength in belts and an improved base for holding mechanical fasteners. Nyfil belts are available for all industrial uses, both light and high tension.

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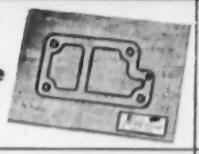
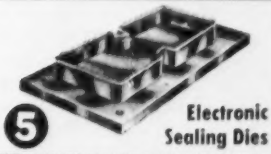
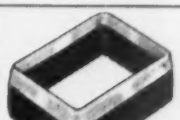
3 Mallet Handle Dies


4 Steel Rule Cutting Dies

2 Steel Rule Clicker Dies


5 Electronic Sealing Dies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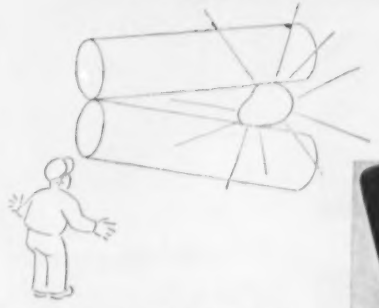
When Lumps show up in the Calender Rolls



It's an even bet that the trouble is too hot mill work. But that is poor consolation for granular rubber or thickened gauge. Mill roll temperature can be easily checked, therefore intelligently controlled by the use of the Cambridge Surface Pyrometer. It is an accurate, rugged instrument that can be used while the rolls are in operation. Its use will help cut costs and make better rubber products. *Send for Bulletin No. 194-SA.*

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Loma Plastic Trash Can

A 22-gallon trash can, molded of Bakelite polyethylene, is being manufactured by Loma Plastics, Inc., 3000 W. Pafford Street, Ft. Worth, Tex. The new can is noiseless, break resistant, non-rusting, non-denting, lightweight, colorful and easy to clean, the manufacturer reports. The lid is black, and the can is available in green,

red, gray or yellow. Colors are molded in so that they cannot be chipped or washed away. The lid locks in place under lugs molded in the top rim as shown above. The lid, however, can be unlocked with a simple twist of the wrist. Top diameter of the can is 20½ inches and the height is 27¾ inches. Rust is no problem, according to the company, since polyethylene resists water, oil, grease, alkalies and acids. Clinging refuse can be washed out of the can with a simple hosing.

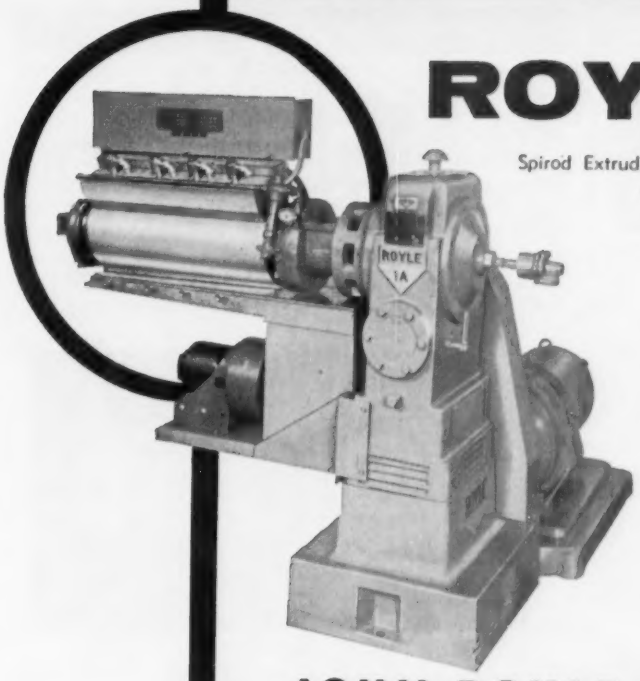
Triple-Tone Vinyl Flooring

Popular patterns and deep dimension colors feature a new line of vinyl flooring that the Flooring Department of the Goodyear Tire & Rubber Co., Akron, Ohio, has made available. "Triple-Tone," the new vinyl flooring is available in 14 colors and is manufactured in .080 gauge in both nine by nine-inch tile and 45-inch wide roll goods for light commercial and residential use. Casual in design, the new terrazzo-type vinyl flooring is comprised of condensed chips of pure color set deeply into background hues.

Dayton Rubber Car Rugs

Dayton Rubber Co., Dayton, Ohio, has announced that a new line of car floor rugs is being added to its list of automotive products. The two-piece rubber rugs for the front seat and one-piece utility rugs for the rear section will be available in eight decorator colors: holiday red, holiday blue, holiday green, desert tan, silver gray, turquoise, white and holiday black.

ROYLE 1A (2½" cylinder bore)



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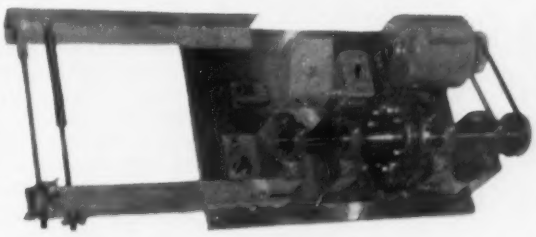

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Self-Sticking Foam Tape

Foamart Co., P. O. Box 373, Short Hills, N. J., has announced the development of "Vita Foam Safe-T-Tape," a self-sealing foam tape that adheres to all surfaces, yet peels off easily. Made of either pure latex foam rubber or polyurethane foam, the material cuts easily into any size or shape. In application, a paper backing is removed and the tape is pressed into place.

The material is said to be ideal for the sealing of windows, for the silencing of doors, for skid-proofing rugs, for the protection of fragile instruments, etc. The new tape is available in a handy dispensing box which contains 3-yards of ¼-inch tape. The foam rubber tape comes in white only, but the polyurethane foam tape is available in a wide range of colors. The photograph above shows the Safe-T-Tape as it is dispensed from its specially-designed box.

Porter Vinyl Electrical Tape

A complete line of vinyl electrical tape manufactured by the Quaker Rubber Division, H. K. Porter Co., Inc., Philadelphia, Penna., has been made available for distribution. The new tape, named "Porter," can be obtained in both 8 and 10 mil thicknesses and in all popular sizes. It can be purchased in individual packages—one 66-foot roll per can—or in a container of five 30-foot rolls. Porter vinyl electrical tape carries the Underwriters Seal of Approval.

The new tape is recommended in place of friction and rubber tape where abrasion exists or where tape is subjected to water, acids, alkalis, or corrosion. It is stated that the tape is tested to 10,000 dielectric volts and, therefore, requires much less wrapping than friction and rubber types. The longer lasting qualities, both in use and in the amount needed to complete a splice, make it more economical than friction and rubber tapes, the company states.

Diatex Rubber Webbing

Firestone Tire and Rubber Co., Akron, Ohio, is now producing a molded rubber webbing which finds use as a suspension for furniture and bedding. Named "Diatex", the product is a strong, resilient, all white rubber webbing which takes the place of steel springs. It can be attached to furniture frames with a metal clip that has been bonded to the webbing. Diatex is ¼ inch thick, 1¾ inches wide and is available in standard lengths of 18, 19 and 20 inches. Other lengths are available on special order.

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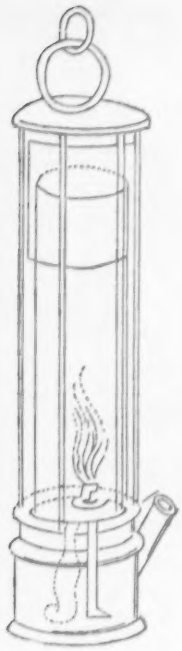

Important dates in the History of Industrial Progress

1816

In mining . . .

Sir Humphrey Davy invented the miner's safety lamp, greatly lessening hazard. Fewer mine disasters meant more coal for Britain's infant industries.

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Johnson Neoprene Pet-Dor

A flexible swinging flap that permits household pets to enter and exit freely has been introduced by the Johnson Pet-Dor Co., Laguna Beach, Calif. The flap is attached to a frame that can be installed in any flush door panel within 15 minutes with the aid of a guide

pattern provided by the company, Johnson claims. The flap is made of soft but thick and flexible neoprene rubber. Permanent magnets in the rubber keep the door tightly closed when not in use, eliminating insects and drafts. When necessary, the entry can be locked.

High-Impact Styrene Sheet

"Campco S-1029," an extruded copolymer styrene sheet, has been made available by Campco Division, Chicago Molded Products Corp., 2717 North Normandy Avenue, Chicago, Ill. The material is said to have outstanding impact strength—even at temperatures as low as −40°F. It also has high tensile and flexural strength and a relatively high heat distortion point. Its chemical resistance is exceptional, particularly to acids and alkalies, the company claims. These characteristics are expected to make the new extruded sheet outstanding for a wide range of industrial applications. Since the extruded sheet is free from internal strain and high in strength, it is readily vacuum-formed into complex shapes. With proper technique, unusually deep draws can be formed. It was also stated that the extrusion process for styrene copolymer makes it economical for the fabricator to obtain this material in short as well as large runs in custom sizes. Material is available in a wide range of colors and in sizes up to 3/16 inch thick.

Sculptured All-Vinyl Playballs

Sun Rubber Co., Barberton, Ohio, has introduced a new line of sculptured all-vinyl playballs patterned after Walt Disney's "Mickey Mouse" and "Donald Duck." The colorful, high-bounce balls are molded of a special vinyl compound and feature washable colors. The balls are approximately 5½ inches in diameter.

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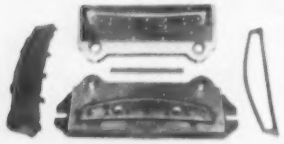

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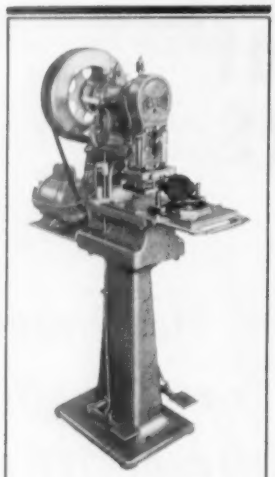

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New Equipment

New Scott Mooney Viscometer

A completely new Mooney Shearing Disc Viscometer, the Model STI, has been developed by Scott Testers, Inc., 85 Blackstone St., Providence, R. I. The device features ease of operation and maintenance, improved stability and added safety. Important facets of the new model include air power closure with safety controls, providing high pressure for closing and low pressure for "holding" during the test period; gear box with new complete sub-assembly, long lived and requiring no adjustments; and vertical shaft and rotor stem, both with

new "square driving" section, which eliminates previous driving key in the shaft and replaces clothes-pin type of rotor stem. A hole all the way through the shaft facilitates cleaning. Another feature is the newly designed aluminum platens, the lower platen being a complete unit with vertical shaft assembly, easily removable for cleaning and repair. The entirely new heating system has exceptionally close control at all temperature levels and has new elevated temperatures of 400°F. and over. Regarding heat transference, new concealed electrical elements and a test cavity depressed into insulated platens provide quick warm-up and changes to various desired temperature levels. Steady readings of the dial indicator are assured by a new thrust bearing and knife-edge integral with horizontal shaft, simplifying calibration adjustment of the measuring system. The Model STI produces the same basic Mooney values as the NBS, the other shearing disc type viscometer conforming to the test methods in ASTM D927-55T and D1077-55T.

Liquids may now be fed evenly into dry materials during blending with the use of a new **liquid-feed blender** developed by the Patterson-Kelley Co., Inc., of East Stroudsburg, Penna. Designed as an integral part of the firm's twin shell blender, the device consists of an improved intensified bar revolving inside the shell blender. Liquid flows from a hollow feeder tube within the bar onto a revolving offset disk from which droplets are flung by centrifugal force. This slinging action plus wiping action of the dry material achieves effective dispersion.

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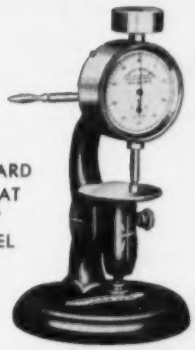

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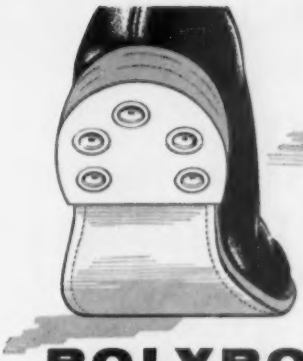

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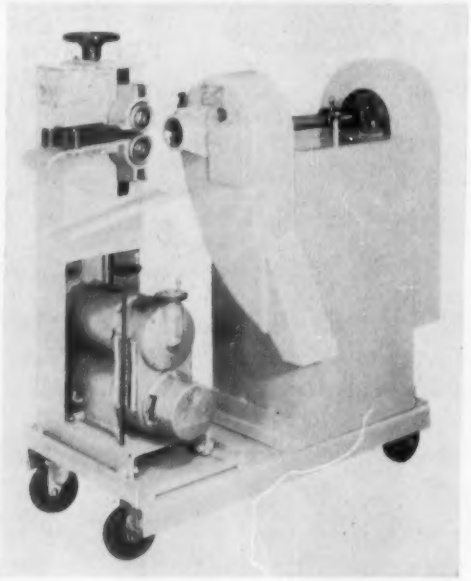
Goodman Improved Power Slug Cutter

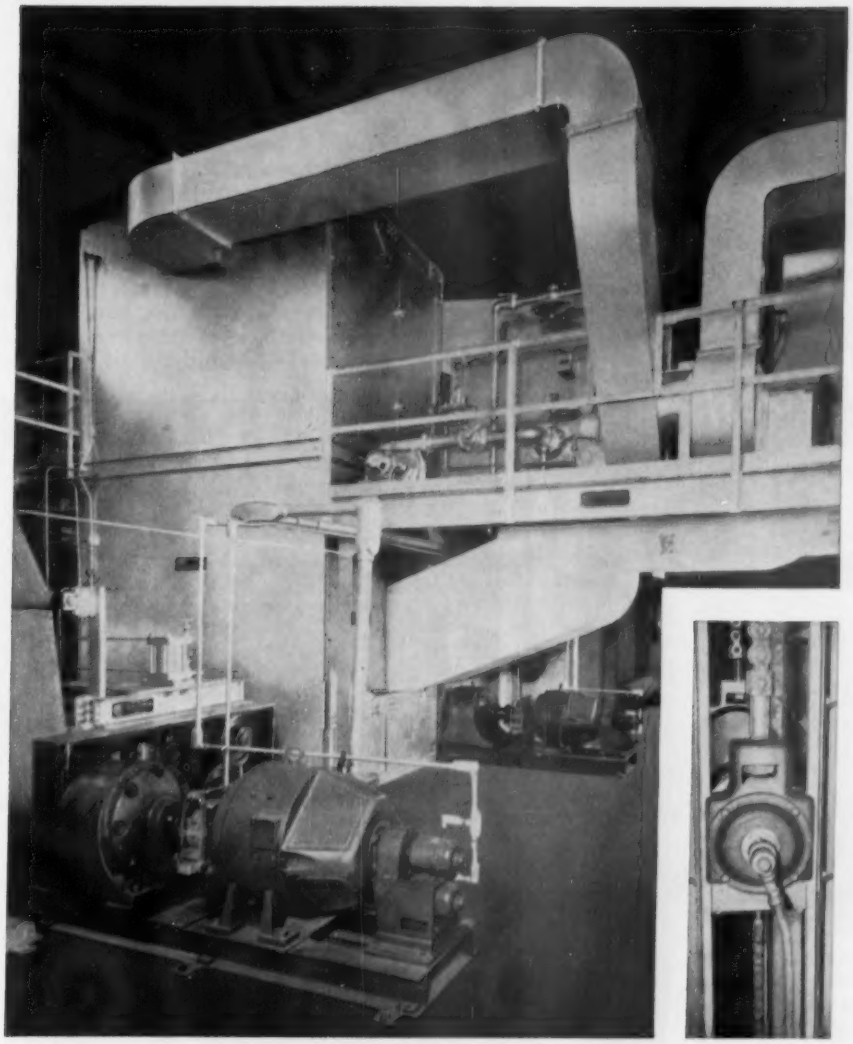
An improved power slug cutter, incorporating a number of new features, has been made available by G. F. Goodman & Son, Richmond St. and East Columbia Ave., Philadelphia 25, Penna. The new unit can cut uncured rubber stock up to three inches in diameter, including flat stock, heavy wall tubing and odd cross-section, with lengths up to four inches on the heavier stock and longer on the lighter stock. Delivery range is infinitely variable from 60 to 1080 cuts per minute. A 1 h.p., totally enclosed motor is furnished. The cutting blades are of



hardened tool steel while the stock feed bushings are of case hardened steel. The power feed will handle stock up to three inches in diameter and is infinitely variable from 15 to 150 feet per minute.

According to the company, two important changes were made to increase the flexibility of the new cutter. First, a swivel caster base was added to allow the machine to be moved as an integral unit. Obviously, if a number of extruders are in operation it is often desirable to move the cutter from one location to another. Second, to speed the operation of changing the stock feed bushings the power feed was redesigned to accommodate ball bearing rollers and mounted on a transverse rack. A simple mechanism indexes the unit in the desired roll groove position and the new design brings the speed control wheel to a handy location. The new slug cutter is said to consistently hold close weight tolerance.

Designed for use where space is severely limited, **miniature Baldwin SR-4 load cells** for electrical measurement of forces and weights up to 10,000 pounds in compression have been developed by the Baldwin - Lima - Hamilton Corp., Philadelphia 42, Penna. The cells are less than 2 inches in diameter and only 2¾ inches high over-all. Calibration accuracy is within plus or minus ¼% of full range at any load at 70° F. Resistance across power terminals is 120 ohms.



Within the first day of startup, full width nylon tire cord processed in this 30-yard-per-minute, 14,000-pound-tension IOI Rollevator® Oven*, was made into aircraft tires meeting all qualification tests.

The Rollevator® roll automatically moves up and down within the oven, in direct relation to line speeds. Thus, *at any line speed, heat-exposure time* of the nylon is held *constant* at a constant temperature setting and at constant tension.

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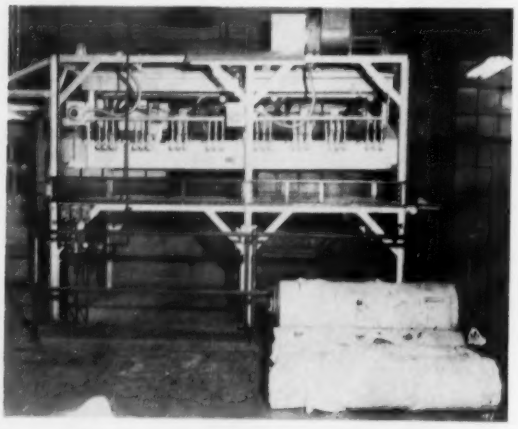
Dawson Vapo Fuser for Coatings

The Vapo Fuser, a product of the F. C. Dawson Engineering Co., of Canton, Mass., is said to provide accurately controlled heat for curing rubber and fusing vinyl or other thermoplastic coatings, up to 20 ounces of coating per square yard of bare stock, to any web material. In operation, steam or air at two to five pounds gauge pressure is passed through a series of superheating tubes, where it is brought into contact with electric heaters. Vapor temperature, brought to any desired point between 200° and 950°F., is held constant



by the heater controls. Hot vapor is discharged into distributing tubes and then driven through small openings against the coated film. This heat-by-conduction is spread evenly over the whole width of the film. Low pressure steam (1½ to 2 Ga.) can be used in any or all sections instead of air as the vehicle to carry the heat from the electric heaters and can be superheated to any temperature up to 950°F. Some of the advantages claimed for the fuser by the manufacturer are faster production, even distribution of heat, accurate maintenance of temperature, assurance of long life, and elimination of fire hazard. The fuser can be had in any length and for any heat requirements, and may also be furnished with explosion-proof fittings for installation in hazardous areas. The unit illustrated is used to cure a 6-mil neoprene coating on 54-inch wide nylon cloth.

Nucor Non-Contact Thickness Gauges

Five types of gauges have been developed by the Nuclear Corporation of America, Inc., Empire State Building, New York 1, N. Y., for non-contact thickness measurement of sheet rubber and rubber coatings. Utilizing beta radiation, the Atom-At series has a range of weights or thicknesses covering all normal manufacturing needs and is said to be accurate within plus or minus 1% of nominal thickness. The basic types available include: transmission gauge for sheet materials; backscatter gauge for coatings; differential gauge for coatings on thin materials; multiple head transmission gauge for greater widths, and the transverse profile portable gauge for measurement across the entire width of a sheet.

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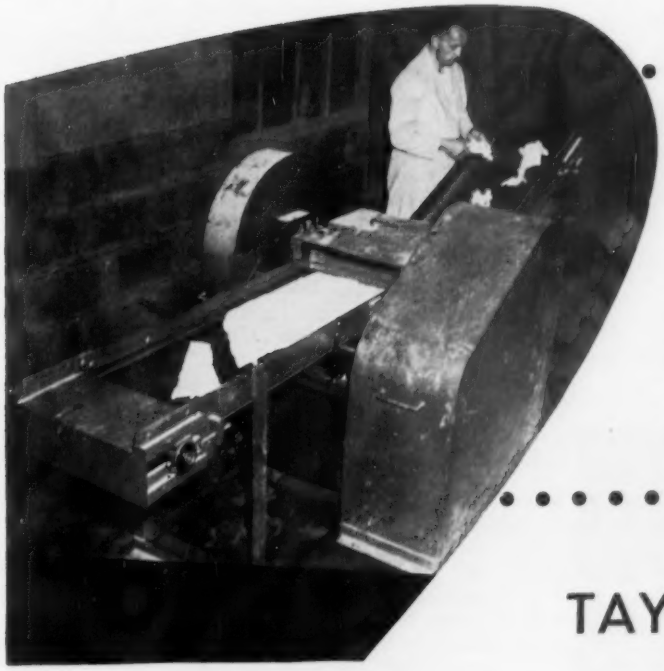

An important manufacturer of rubber adhesives made from synthetics and natural rubber formerly cut slabs of raw stock manually to ready them for churning. The work was slow and arduous. Quality suffered because undissolved rubber was filtered out. As a result the end product was not uniform.

After trying another make mechanical cutter which didn't work because the rubber wrapped around the knives, the manufacturer installed a Taylor-Stiles Rubber Cutter. The rubber was cut into small and even strips. Churning time was reduced 25%. Solvent losses have been reduced to almost nothing. And uniform quality has been assured since all the rubber is now dissolved.

For further details regarding this and other Taylor-Stiles rubber cutters write for illustrated, descriptive folder APP 202.

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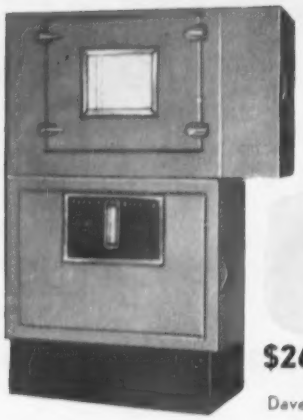

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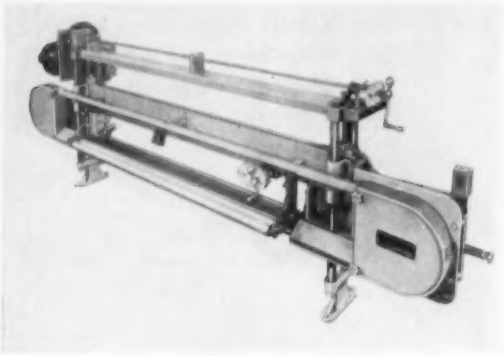
Mogul Rubber Company
International Latex Corp.
Chrysler Corporation
General Motors Corp.
Thiokol Chemical Corp.
Geauga Industries Company

FOR FURTHER INFORMATION
WRITE

mast development company, inc.
DAVENPORT, IOWA

Splitting Head for Foam Materials

A new vertically adjustable splitting head to slice foam rubber, polyvinyl, polyurethane and similar materials, designed by the Campbell Machinery Development Co., has been introduced by the Falls Engineering and Machine Co., Cuyahoga Falls, Ohio. Manufacturers of foam materials may install the new head on their present equipment and split materials to almost any desired thickness. Available in four widths—48, 64, 72 and 84 inches—the unit is installed across the conveyor belt and adjusts vertically to split stock moving along the



belt. It may be installed as a single unit or in a series along the conveyor line.

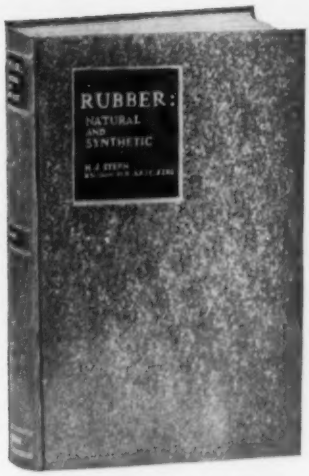
The new splitting knife is equipped with a ¾-inch scalloped knife edge. The knife is driven around two 14-inch semi-steel wheels and is completely guarded except at the cutting edge. An aluminum compression roll located directly above the cutting knife is said to assure accurate splitting by holding the stock firmly and evenly against the belt as it is fed into the cutting edge of the knife. Both roll and blade are adjustable by means of separate micro dial gauges which are easily accessible to the operator. Power equipment to automatically lower or raise the knife is optional.

The unit, with a maximum vertical adjustment of 12 inches, will split most materials to ⅛th of an inch or even thinner on firmer stocks. In addition to the materials mentioned above, the new splitting head can also be used for bonded foam, rubberized hair, cellulose sponge and resin-bonded fiber.

The **Viking Void Detector,** developed by Viking Instruments, Inc., East Haddam, Conn., tests rubber materials up to .025-inch thick and records holes of 1/64-inch diameter and larger. A feeler brush attached to the roll, plate or bar processing the dielectric material passes over the voids and a low voltage pulse is then transmitted to the indicator unit via electrical connection.

Quick, accurate evaluation of the resistance to surface abrasion of rubber and other materials under cold, wet and dry conditions is said to be effected with a new **automatic abrader** developed by the Taber Instrument Corp., North Tonawanda, N. Y. Dual abrading wheels, unique in testing methods, traverse a complete 360° circle on the surface to be tested.

first edition . . .



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B.Sc., Ph.D., A.R.I.C., F.I.R.I.

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About the Book—

This book fills the need for an English-language text book on all phases of rubber and rubber products manufacture. As indicated by the chapter heads, the book is of interest to rubber manufacturers, suppliers of chemicals and machinery, rubber technologists and to students of rubber who will find present-day technical procedures clearly defined.

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About the Author—

Dr. Stern has been engaged as a chemist in the rubber industry for more than 25 years and since 1935 has practiced successfully in London as a Consultant. He is the author of "Practical Latex Work" and of many publications concerned with the scientific and technological aspects of natural and synthetic rubber.

SUMMARY OF CONTENTS BY CHAPTERS

Part I

1. **Historical Introduction; Mastication; Vulcanization.**
2. **Plantation Rubber.**
3. **Natural Rubber: Composition, Reactions, Derivatives.**
4. **Properties of Vulcanized Rubber.**
5. **Compounding Ingredients.**
6. **Rubber Machinery; Solvents and Solutions; Reclaiming.**
7. **Latex.**

Part II

8. **Synthetic Rubber (History and Development).**
9. **Manufacture and Technology of Synthetic Rubbers.**
10. **Synthetic Rubber Latices.**
11. **Synthetic Resins; Plastics.**
12. **Manufacturing Processes (of various rubber products).**
13. **Testing and Analysis.**

Sources of Further Information; Metric Equivalents; Subject Index.

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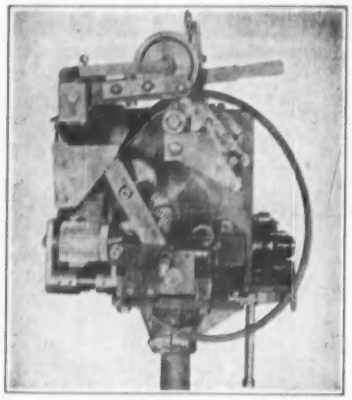

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Reviews

BOOKS

Ageing and Weathering of Rubber. By J. M. Buist. Published by the Institution of the Rubber Industry, 4 Kensington Palace Gardens, London, W.8, England. 6 x 8½ in. 144 pp. $4.00.

(Available from Book Department, Rubber Age)

Second in the series which is being sponsored by the I.R.I. Council, this monograph deals lucidly and comprehensively with the theory and prevention of the degradation of rubbers. Written by an acknowledged expert, it covers the aging of raw and vulcanized rubbers, covering both the fundamental chemistry governing the reactions involved and the contribution attributable to basic physical factors. As the author indicates in his preface, the newer test methods present their own problems of interpretation and the field of testing remains full of interesting and exciting research problems.

After an introductory chapter, in which is discussed the structure of natural rubber, molecular weight, vulcanization, vulcanizing agents, accelerators and fillers, the author devotes specific chapters to these subjects: Oxidation of Olefins: Normal Aging and Aging Accelerated by Metallic Catalysis; Flex-Cracking and Atmospheric Cracking; Accelerated Aging Tests, Individual Containers and Inter-Laboratory Comparison of Accelerated Aging Tests; Additional Methods of Assessing Aging. The final chapter is devoted to the classification and description of the 125 antioxidants at present offered commercially. An interesting portion of this chapter is a brief discussion of the terminology which is applied to chemical substances which are used to protect rubber from deterioration.

The author is thorough in his approach in that not only are standard aging methods discussed and evaluated, but he also enters into additional methods, principally oxygen absorbtion tests and stress relaxation tests. Brief mention is also made of the deleterious effects of soil micro-organisms on rubber. Each chapter in the monograph has an extensive bibliography and author and subject indexes are included.

•

Calenders for Rubber Processing. By H. Willshaw. Published by the Institution of the Rubber Industry, 4 Kensington Palace Gardens, London, W.8, England. 6 x 8½ in. 62 pp. $4.00.

(Available from Book Department, Rubber Age)

Another in the series of monographs currently being issued by the I.R.I., this one, as indicated by its title, is devoted to calenders. According to the author, its object is to describe the uses and developments of calenders in a manner that will appeal to all classes of persons engaged in the rubber industry. Accordingly, it cannot be regarded as a treatise on the designing, manufacture and installation of calenders, but it most certainly can be looked upon as an excellent outline of applications, starting from the pioneering work of Thomas Hancock.

In his introductory chapter, Mr. Willshaw discusses the purposes and uses of rubber calenders and digs back into some of the early records. His next five chapters are concerned with calender design, types of calenders, ancillary equipment (such as driving gears, speed control systems, safety braking systems, reel-off and batch-up gear, and thickness gauges), roll contours, and uses in production. A short, concluding chapter points out the fact that a basic similarity exists between old and new calender design. The prediction is made that there will be no fundamental changes in the art of calendering within the next few decades.

In addition to 36 illustrations, a list of references and a subject index, the monograph includes a glossary of terms. While some of these terms are generally in use within the rubber industry, many of them are directly associated with calenders and calendering.

Modern Plastics Encyclopedia—1956. Published by Modern Plastics, 575 Madison Avenue, New York 22, N. Y. 8¼ x 11½ in. 1122 pp.

This widely accepted and valuable encyclopedia has been greatly expanded, reflecting the growth of the plastics industry in recent years. In the 1956 issue, every effort has been made to condense basic information, to establish a foundation upon which readers may build a file of information on developments yet to come, and to present all recent technical and engineering progress in sufficient detail to enable readers to acquire a requisite background. It is to be noted that the Primer of Plastics and the Plastics Glossary, two sections which proved so popular in the 1955 edition, have been expanded to cover fundamentals more fully and to embrace recent additions to the technical language of plastics. These features are recommended to new readers and as a "brush-up" course to industrial end-users of plastics.

Major sections in the 1956 encyclopedia include "Resins and Molding Compounds," "Fillers and Reinforcements," "Chemicals for Plastics," "Laminates and Reinforced Plastics," "Film and Sheeting," "Engineering and Methods," "Fabricating and Finishing," and "Machinery and Equipment." A section headed "Technical Data" offers much valuable information on statistics of the industry, plastics properties, films, adhesives, coatings, laminates, etc. An extensive bibliography is also included in this section. The Directory Section contains, as in the past, a listing giving alphabetically the street and city address of every company mentioned. The articles which appear in many of the sections are attractively presented and contain much illustrative material. An extensive index facilities the location of any subject or article in the encyclopedia.

•

Industrial Vision. By H. W. Hofstetter. Published by the Chilton Co., Chestnut and 56th Streets, Philadelphia 39, Penna. 6¼ x 9½ in. 189 pp.

It should be noted that over 10,000 men and women permanently lose part of the vision of one or both eyes as the result of industrial accidents each year. These alarming statistics more than justify this comprehensive analysis and review of industrial vision which is designed to familiarize the reader with the visual problems and characteristics of occupational groups. Planned as an informative guide and text, the book illustrates the relationship of vision, visual testing and visual skills to industrial performance, production and safety. An interpretation of vision is made in terms of visual acuity, extra-ocular muscle imbalance, color vision, stereopsis, and visual field anomalies. The scope of the subject is limitless — visual testing in industry, industrial eye hazards and production, visual and industrial efficiency, industrial compensation, visual tests for driving ability, and the relationship of vision and visual testing to driving ability.

•

The Condensed Chemical Dictionary. (5th Edition). By Arthur and Elizabeth Rose. Published by the Reinhold Publishing Corp., 430 Park Avenue, New York 22, N. Y. 6 x 9 in. 1200 pp. $12.50.

This entirely new, greatly enlarged edition will prove, more than ever, one of the most valuable chemical reference books in any language. Now with over 30,000 entries, this new edition is the largest and most complete chemical dictionary in both number and kind of entries, as well as in extent of essential information offered under each. Included are data on the chemical and physical properties of chemicals and raw materials, newest information on containers, shipping regulations and safety instructions, and new uses of chemicals in nuclear energy, chemotherapy and other fields of current interest. Many new cross-references help clarify the confusion often associated with chemicals and synonyms. Up-to-the-minute information on trade names and trade marked items is also included in this comprehensive dictionary.

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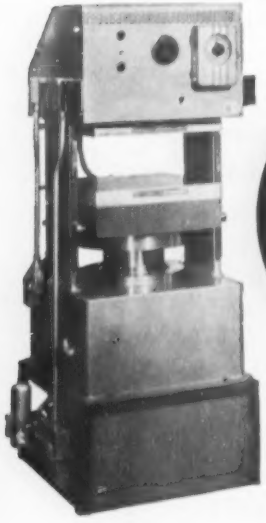

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8"& 12" Daylight.
8" stroke with down stroke trip.

larger presses built to customers specifications

Write for Circular
PASADENA HYDRAULICS INC.
279 N. Hill Avenue
Pasadena 4, California

P·H·I
PRESS

BOOKLETS, CATALOGS, etc.

Maglite D in Neoprene. (Bulletin No. 5606B). Marine Magnesium Division, Merck & Co., Inc., Rahway, N. J. 8½ x 11 in. 19 pp.

The functions and advantages of Maglite D, the firm's fine particle size, highly active, free flowing magnesium oxide, in neoprene compounds are outlined in this bulletin. Chemical and physical analyses of Maglite D are also presented. Compounds featuring Maglite D are shown. These include Neoprene GN-A, both gum and control compounds; Neoprene W control compounds with both NA-22 and Permalux accelerations; Neoprene W with increased NA-22 acceleration for light duty wire and cable sheath; and Neoprene GN wire and cable. Physical properties of each compound are tabulated under cure, stress, tensile strength, ultimate elongation and hardness. The information contained in the tables is also translated into graphs.

•

Taylor-Stiles Cutters. (Bulletin Nos. 212 and 213). Taylor, Stiles & Co., Riegelsville, N.J. 8½ x 11 in. 4 pp. each.

Information on Taylor-Stiles general purpose and dicing cutters or pelletizers is contained in these two bulletins. Bulletin No. 212 gives information on the company's line of general purpose cutters. A sketch and two photos show the design and operation of the cutters. Specifically they show how stock is brought to the feed rolls and how the feed rolls hold the stock firmly close to the cutting edge. Bulletin No. 213 gives information on three types of dicing cutters or pelletizers manufactured by the company. Sketches show the operating principle of the cutters as well as three types of slitting knives. A table giving specifications on the cutters is included.

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Barrett Standard Industrial Chemicals: 1956. Barrett Div., Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y. 8¼ x 11 in. 16 pp.

Divided into 20 sections, this catalog contains concise descriptions and uses of each of the company's line of chemicals, most of which are of coal-tar origin. Listing compounding materials which have wide application with reclaim and synthetic as well as natural rubber compounds, the catalog describes and gives a suggested use for each chemical. Pertinent data with regard to shipping of these materials is included. Materials described include plasticizers, cumar resins, tar acids, phthalic and maleic anhydride, tar acid oils, fumaric acid, aromatic industrial solvents and pickling inhibitors.

•

Chlorowax LV—A Secondary Plasticizer for Vinyl Resins. Diamond Alkali Co., 300 Union Commerce Building, Cleveland 14, Ohio. 8½ x 11 in. 5 pp.

This technical bulletin describes Chlorowax LV, a liquid chlorinated paraffin, and lists its typical properties. Typical compounds containing Chlorowax LV are presented including those for hose, film and plastisols. The bulletin concludes with an illustrated description of a 24-hour plasticizer exudation test for vinyl stocks. Recommendations for the best use of Chlorowax LV are made and examples of highly solvating plasticizers which may be employed as primary plasticizers for greater compatibility are given.

•

Metasap Vinyl Stabilizers. Metasap Chemical Co., Harrison, N. J. 8½ x 11 in. 6 pp.

Properties and suggested applications of the company's extensive line of vinyl stabilizers are tabulated in this brochure. Among the products listed are plastisols, film and sheeting, floor tile, and various forms of extrusion. Data are furnished on chemical composition, fatty acid and ash content, moisture and specific gravity. Characteristics imparted to the various formulations are emphasized.

Farrel-Birmingham 6 x 13-inch Laboratory Mills for Rubber and Plastics. (Bulletin No. 203). Farrel-Birmingham Co., Inc., Ansonia, Conn. 8½ x 11 in. 12 pp.

Described in this bulletin are six standard laboratory mills manufactured by Farrel-Birmingham for the rubber and plastics industries. General and electrical specifications are given, as well as illustrations and diagrams of each model. Two models feature separate frames and gear housings and single motor drive with constant speed, and are for roll temperatures up to 270° and 350° F., respectively. The other machines have integral frames and gear housings, are for maximum roll temperatures of 350° F., and may be equipped for operation up to 450° F. Drives for these latter four are single motor-constant speed, single motor through vari-pitch pulleys, two motors through vari-pitch pulleys, and two motors with adjustable-voltage control. Also included in the bulletin are data on accessories and extras such as rolls, scrapers, guides and safety trips.

•

Swelling of Neoprene in Chemicals, Oils and Solvents. (Report No. 56-2). Elastomers Division, E. I. du Pont de Nemours & Co., Wilmington, Delaware. 6¼ x 9½ in. 40 pp.

This two-part report, consisting of previously published material plus data of more recent vintage, shows the volume change of various neoprene compounds after immersion in a large number of chemicals, oils and solvents. The data in Part I, still applicable, were prepared by R. W. Malcolmson in 1948. Results of tests conducted since that time appear in Part II, assembled by D. C. Thompson. Swelling effects of 114 materials not included in the first report are shown, as well as values for 47 materials previously included in other applications or under other conditions. Part I concerned Neoprene Types GN and GN-A, whereas Part II also includes Neoprene W, WHV, WRT, GRT and S as well as two latex types.

•

Dayton Poly-Koolfoam. Dayton Rubber Co., Dayton, Ohio. 8¼ x 10¾ in. 16 pp.

Inviting the reader "to enter a New World of incredible opportunities," this illustrated booklet deals with the story of foam synthetics with respect to industrial and business opportunities. Included is a brief history of synthetic foams as well as a simplified account of the ways various components combine to react to produce polyurethane foams. The booklet outlines the production facilities available at Dayton Rubber for making Poly-Kool foam and discusses its fabrication, properties and uses. A description of the company's research and production facilities in all lines of the rubber industry is also given.

•

An Adventure in Profits. Mobay Chemical Co., 1901 South 2nd St., St. Louis 4, Mo. 12 x 9 in. 24 pp.

Designed to acquaint the reader with flexible urethane foams, this illustrated booklet explains what they are and why they are something new for industry. A discussion on the properties possessed by these foams includes data on compressive strength, stretch and tear strength, wear resistance, solvent and chemical resistance, heat and flame resistance and low temperature performance. The booklet also discusses the fabrication and application of the material to such products as athletic and recreational equipment, automotive products and household products.

•

Kel-F Fluorocarbon Products. Chemical Manufacturing Div., M. W. Kellogg Co., P.O. Box 469, Jersey City 3, N. J. 8½ x 11 in. 8 pp.

The forms, properties and uses of a wide range of fluorocarbon products, from plastic resins to acids and dielectric fluids, are described in this brochure. Also included are the types and grades available of each form of fluorocarbon product and their suggested uses. The fluorocarbon products described consist of a fluorocarbon rubber series, oils, waxes and greases, molding and extrusion plastics, dispersions and coating resins, printing inks, acids and alkanes.

Improved Performance

for Neoprene Compounding

- **Better Curing**
- **Better Physicals**

GENMAG MLW

Magnesium Oxide

Bulk Density	18-22 Lbs.
Moisture	Nil
MGO (Ignited Basis)	97.9%
Chlorides	Nil
Manganese	.0003%
Activity	Moderate

General Magnesite
& MAGNESIA COMPANY

P. O. Box 671 - Norristown, Pa.

MARKET REPORTS

TRENDS
NEWS
PRICES

Natural Rubber

Since our last report (September 30), the price of spot rubber on the New York Commodity Exchange has moved in a range of 349 points, high for the period being 35.37c reached on October 31, and low being 31.88c reached on October 9 and again on October 18. The average price of spot rubber for the month of October was 32.68c based upon 22 trading days. This compares with an average of 32.64c in the previous month.

The disturbances in the Middle East and strikes and riots in Singapore have created widespread nervousness in the rubber markets here. At the close of the month, rallying tendencies continued the rule in world markets. Sharp advances in Singapore were matched in London while the New York market also moved up impressively.

Renewed Chinese Buying

A market factor which cannot escape observation is that of renewed Chinese buying from Malaya. Although nearly 10,000 tons have been reportedly sold to Peiping, there is always the prospect that the volume purchased could be moderately enlarged before the end of this year.

If such proves the case, it would turn the present narrow surplus condition of the Far East into a deficit status sooner than is now expected. If rumors concerning Chinese buying intentions prove correct, surpluses as between natural rubber production and anticipated consumption may disappear by December.

Meanwhile, from a broad statistical approach, it appears that for 1956 world production of natural rubber may not exceed 1,885,000 tons and that consumption may not be below 1,850,000. This would mean that the surplus this year would be no larger than the also negligible surpluses of the past two years.

As for the first half of next year, it seems almost inevitable, many in the trade believe, that natural's consumption will exceed its production. Unless the world-wide money and credit situation tightens further and/or the synthetic preference ratio returns to a 65% level as it did a few years ago, there is good reason to expect that 1957 would show a deficit of production to consumption, the first in natural rubber since the war year of 1945.

All the foregoing, of course, hinges upon an early cessation of hostilities in the Middle East or an isolation of the conflict to narrow limits. Were the Suez Canal to be blocked for an extended period of time, there would be great repercussion on the entire natural situation and an inevitable turn to synthetics.

Stockpile Question Remains

Elsewhere in this issue there appears a report that GSA has rejected an industry proposal designed to make more rubber available for civilian consumption by delaying deliveries to the rubber stockpile. GSA notified the industry that the program was not necessary in the light of current conditions. Shortly afterward, the conflict in the Middle East began. In the light of these new developments, it may yet be that some further thought will have to be given to this entire stockpiling question.

NEW YORK, OCTOBER 31, 1956

Price Data

Closing Rubber Prices on New York Commodity Exchange

FROM OCTOBER 1 TO OCTOBER 31

Oct.	(No. 1 R.S.S.) Spot	Dec.	Rex Nov.	Jan.	Mar.	Sales
1	32.25	32.40	31.85	31.55	31.20	728
2	32.25	32.40	32.00	31.80	31.40	796
3	32.75	33.15	32.50	32.30	32.10	818
4	32.50	32.95	32.10	32.03	31.75	826
5	32.50	33.15	32.35	32.15	31.75	829
6	....	....	....	....	....	....
7	....	....	....	....	....	....
8	32.25	32.85	32.15	32.10	31.80	846
9	31.88	32.40	31.55	31.45	31.20	872
10	32.88	32.60	31.84	31.80	31.50	901
11	32.13	32.85	32.10	32.00	31.80	887
12	....	....	....	....	....	....
13	....	....	....	....	....	....
14	....	....	....	....	....	....
15	32.13	32.90	32.15	32.10	31.80	898
16	32.25	33.00	32.30	32.15	31.90	903
17	32.25	33.10	32.35	32.15	32.00	901
18	31.88	32.60	32.05	31.85	31.60	938
19	32.00	32.80	32.20	31.94	31.75	974
20	....	....	....	....	....	....
21	....	....	....	....	....	....
22	32.13	33.00	32.40	32.05	31.80	969
23	32.13	32.75	32.30	31.92	31.77	973
24	32.50	33.30	33.10	32.45	32.20	977
25	32.75	33.70	33.25	32.65	32.35	1016
26	33.37	34.40	34.00	33.18	32.75	1056
27	....	....	....	....	....	....
28	....	....	....	....	....	....
29	34.13	35.30	35.00	34.15	33.60	1081
30	34.75	36.00	35.40	34.80	34.25	1122
31	35.37	36.40	36.00	35.30	34.95	1171

Outside Market

No. 1 Ribbed Smoked Sheets:	
Spot	.35⅝
November	.35⅝
December	.35¾
Thin Latex Crepe:	
Spot	.44½
Thin Brown Crepe, No. 2	.28¼
Flat Bark Crepe	.22½

London Market
(Standard Smoked Sheets)

Jan.-Mar.	35.36 - 35.65
Apr.-June	34.20 - 34.35

Singapore Market
(Standard Smoked Sheets)

Dec.	34.02 - 34.09

Middling Upland Quotations

	Sept. 28 Close	October 31 High	Low	Close
Dec.	34.17	34.13	33.82	33.85
Mar.	34.30	34.20	33.90	34.09
May	34.07	34.28	34.04	34.21

Notes & Quotes

According to W. F. Billingsley, manager of tire construction and design for the B. F. Goodrich Tire Co., Akron, Ohio, about 75-85% of the rubber in the average passenger car black tire is made in America from oil and gas derivatives, instead of being imported from Africa or the Far East. Back in 1945, when tires of synthetic rubber first became available in quantity to the general public, 99% of the total rubber in them was synthetic, Mr. Billingsley stated. Since then, the synthetic content has varied from 50% to 99%, depending on the relative cost and availability of natural and synthetic rubbers. He pointed out that today's tire is much superior to the 1941 tire that was made from 100% natural rubber. "Tires today are safer at all speeds and considerably more durable," he declared.

Synthetic Rubber

GR-S type synthetic rubber exports appear headed for the first 100,000 ton year in history, according to the U. S. Department of Commerce. The Department's Business and Defense Services Administration reported exports of 67,791 long tons during the first half of 1956, "pointing toward a total for the year of well over 100,000 long tons." Previous high was 98,380 tons shipped in 1944, a World War II year.

This year's shipments are particularly significant in the light of last year's showing for the same period—only 16,209 long tons valued at $8,672,953, one-fourth of the $32,342,691 for January-June, 1956. Exports for the last half of 1955 totaled 44,435 long tons worth $24,200,000.

The United Kingdom, France and West Germany are the largest consumers of GR-S type rubbers, followed by Mexico, Australia, Union of South Africa, Canada and Italy. These eight countries accounted for 75% of the total during the period January-June.

U. S. Consumption Figures

The Rubber Manufacturers Association reports that consumption of all types of synthetic rubber in the United States during September amounted to 68,548 long tons as compared with August's consumption of 71,465 long tons. Of the total new rubber consumed during September, synthetic rubbers accounted for 61.17% which is above the August ratio of 60.79%.

Production of all types of synthetic rubber within the United States during September amounted to 90,546 long tons in comparison with 86,468 long tons produced in August. As of September 30, there were 199,535 long tons of synthetic rubber in stocks, compared with the 191,253 on hand at the end of the previous month.

RMA estimates that in the first nine months of the current year, 814,333 long tons of synthetic rubber were produced in the United States and 648,711 consumed. The Association's estimates show that in the first nine months of 1956, 116,059 long tons of synthetic rubber were exported from the United States.

NSF Research Grants

Elsewhere in this issue there appears an accounting of the progress made by the National Research Foundation to quicken progress in fundamental research and development of high polymer elastomers. To support 17 basic research projects in high polymers during the next three years, NSF distributed $687,000 among universities, and the National Bureau of Standards.

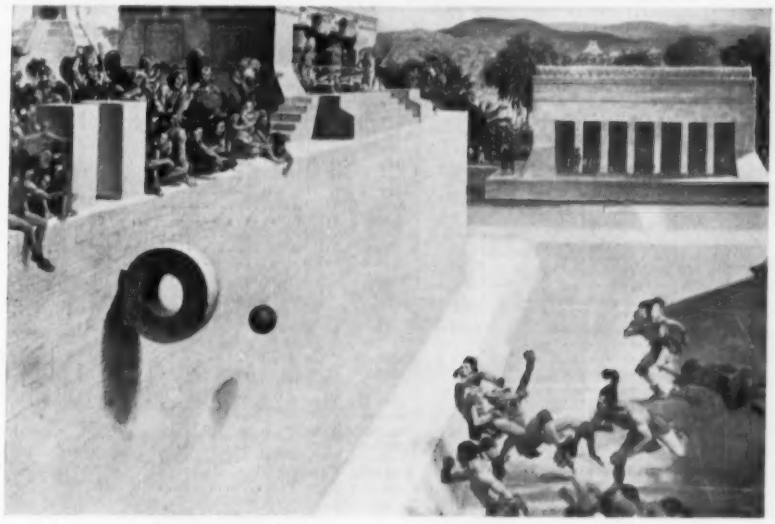
Several of this year's grants will support the quest for new inorganic polymers that possess high temperature stability. Among inorganic rubbers whose structures will be probed are the phosphonitrile chlorides, plus a long list of polymers to be made, many for the first time, from such elements as boron, aluminum, germanium, titanium and tin. Other grants will cover mechanisms of polymerization, rheology of polymer solutions, molecular weight distribution of polymers, physical chemistry of high polymers, etc.

CYANAMID RUBBER

Chem Lines

NO. 7
OF A SERIES

Published by AMERICAN CYANAMID COMPANY, Rubber Chemicals Department, Bound Brook, New Jersey



Rubber Ball Used in Mexican "Basketball" Game . . . 1200 A.D.!

"Baskets" didn't come easily in this ancient game played by the Mayans long before the arrival of the Spanish invaders. The ball was heavy; almost a foot in diameter and virtually solid rubber. Only knees, thighs and hips could be used to propel the ball – and the ring opening was but slightly larger than the ball. A "basket," in fact, meant victory . . . and since by tradition the victors were entitled to the garments and possessions of the fans who watched, victory was usually followed by a stampede of spectators away from the ball court.

The illustration above, reproduced from John Clymer's painting for the 1957 Cyanamid calendar, shows a typical Mayan game court at Chichen Itzá, Mexico.

The ball used in this game of POK-TA-POK is just one example of the use to which rubber was put by the American Indian. Watertight shoes, flasks, ponchos, dolls and other items were made from the sap of latex-yielding shrubs. Research has also established that rubber was used for many medicinal purposes, and had an important place in religious rites.

The development and use of natural rubber by the American Indian is impressive, for in 300 years, his "civilized" conquerors made little improvement in the ancient method of rubber manufacture.

As we know today, it takes *chemicals* to convert rubber into useful, versatile products. Rubber technology now goes far beyond stabilization through sulfur vulcanization. It depends on a variety of rubber chemicals to aid in each processing step and greatly improve product properties. The complexity of rubber technology makes it difficult to make the optimum selection of chemical additives for each product type . . . but here is where the specialized lab and field experience of Cyanamid's Rubber Chemicals Department can be of help. Our full line of accelerators, antioxidants, retarders, and peptizers can be called on to benefit your process or product.

Equivalent-Cure Calculations Made Easy

At one time or other, every rubber chemist or compounder has had to refer to the temperature coefficient of vulcanization. It has been found that this coefficient is approximately 2.0 for every change in temperature of 10°C or 18°F. Thus, if you wish to translate a 280°F laboratory cure to a factory cure at 298°F, you would divide the time for the optimum cure found in the laboratory by 2.0 (since there is a temperature difference of exactly 18°F), to obtain the proper factory cure time.

Our Rubber Chemicals Catalog contains an equivalent cure-or-scorch chart which has found wide desk use as an aid to these calculations. Now we have incorporated this information into a handy, pocket slide rule which can be conveniently carried anywhere, enabling you to make rapid calculations, of cure and scorch equivalents "on the spot."

The handy slide rule is illustrated above. If you would like to have one, contact the Cyanamid Rubber Chemical sales representative in your area, or write to us directly.

PRICES OF COMMERCIALLY AVAILABLE SYNTHETIC RUBBER POLYMERS

(dry types—per pound carload unless otherwise specified)

Butadiene-Acrylonitrile Types

Butaprene NAA	.5400 [1]
Butaprene NF	.4900 [1]
Butaprene NL	.5000 [1]
Butaprene NXM	.5800 [1]
Chemigum N1	.6400 [2]
Chemigum N3	.5800 [2]
Chemigum N5	.5800 [2]
Chemigum N6	.5000 [2]
Chemigum N7	.5000 [2]
Hycar 1001	.5800 [2]
Hycar 1002	.5000 [2]
Hycar 1014	.6000 [2]
Hycar 1041	.5800 [2]
Hycar 1042	.5000 [2]
Hycar 1043	.5000 [2]
Hycar 1312	.6000 [2]
Hycar 1411	.6200 [2]
Hycar 1432	.5900 [2]
Hycar 1441	.6200 [2]
Paracril AJ	.4850 [2]
Paracril B	.5000 [2]
Paracril BJ	.5000 [2]
Paracril BLT	.5000 [2]
Paracril C	.5800 [2]
Paracril CV	.5900 [2]
Paracril D	.6500 [2]
Paracril 18-80	.6000 [2]
Polysar Krynac 800	.5000 [2]
Polysar Krynac 801	.5800 [2]
Polysar Krynac 802	.5000 [2]
Polysar Krynac 803	.5000 [2]

Butadiene-Styrene Types

Ameripol 1001	.2410 [2]
Ameripol 1002	.2435 [2]
Ameripol 1006	.2410 [2]
Ameripol 1500	.2410 [2]
Ameripol 1501	.2410 [2]
Ameripol 1502	.2410 [2]
Ameripol 1703	.2060 [2]
Ameripol 1705	.2035 [2]
Ameripol 1706	.2035 [2]
Ameripol 1707	.1910 [2]
Ameripol 1709	.1885 [2]
Ameripol 1710	.1885 [2]
Ameripol 1711	.1885 [2]
Ameripol 1712	.1885 [2]
ASRC 1000	.2410 [2]
ASRC 1001	.2410 [2]
ASRC 1004	.2410 [2]
ASRC 1006	.2410 [2]
ASRC 1500	.2410 [2]
ASRC 1502	.2410 [2]
ASRC 1703	.2060 [2]
ASRC 1708	.1910 [2]
Baytown 1600	.1850 [2]
Baytown 1601	.1850 [2]
Baytown 1602	.1850 [2]
Baytown 1801	.1700 [2]
Copo 1500	.2410 [2]
Copo 1502	.2410 [2]
Copo 1712	.1885 [2]
FR-S 1000	.2300 [2]
FR-S 1001	.2300 [2]
FR-S 1004	.2300 [2]
FR-S 1006	.2300 [2]
FR-S 1009	.2600 [2]

Butadiene-Styrene (Cont'd)

FR-S 1010	.2650 [2]
FR-S 1012	.2700 [2]
FR-S 1013	.2600 [2]
FR-S 1015	.2800 [2]
FR-S 1500	.2300 [2]
FR-S 1502	.2300 [2]
FR-S 1703	.1950 [2]
FR-S 1705	.1925 [2]
FR-S 1710	.1775 [2]
Naugapol 1016	.2650 [2]
Naugapol 1018	.2700 [2]
Naugapol 1019	.2650 [2]
Naugapol 1021	.3000 [2]
Naugapol 1022	.2800 [2]
Naugapol 1023	.2850 [2]
Naugapol 1503	.2625 [2]
Naugapol 1504	.2950 [2]
Philprene 1000	.2410 [1]
Philprene 1001	.2410 [1]
Philprene 1006	.2410 [1]
Philprene 1009	.2550 [1]
Philprene 1018	.2700 [1]
Philprene 1019	.2650 [1]
Philprene 1500	.2410 [1]
Philprene 1502	.2410 [1]
Philprene 1503	.2625 [1]
Philprene 1601	.1910 [1]
Philprene 1605	.1870 [1]
Philprene 1703	.2060 [1]
Philprene 1706	.2030 [1]
Philprene 1708	.1910 [1]
Philprene 1712	.1880 [1]
Philprene 1803	.1720 [1]
Philprene 1806	.1760 [1]
Plioflex 1006	.2410 [2]
Plioflex 1502	.2410 [2]
Plioflex 1703	.2060 [2]
Plioflex 1710	.1885 [2]
Plioflex 1773	.2060 [2]
Plioflex 1778	.1910 [2]
Polysar Kryflex 200	.2410 [2]
Polysar Krylene	.2410 [2]
Polysar Krylene NS	.2410 [2]
Polysar Krynol 651	.1885 [2]
Polysar Krynol 652	.1910 [2]
Polysar S	.2410 [2]
Polysar S-50	.2410 [2]
Polysar S-X 371	.2550 [2]
Polysar SS-250	.3000 [2]
S-1000	.2300 [2]
S-1001	.2300 [2]
S-1002	.2325 [2]
S-1006	.2300 [2]
S-1011	.2325 [2]
S-1013	.2300 [2]
S-1100	.1850 [2]
S-1500	.2300 [2]
S-1501	.2300 [2]
S-1502	.2300 [2]
S-1600	.1850 [2]
S-1601	.1850 [2]
S-1602	.1850 [2]
S-1703	.1950 [2]
S-1705	.1925 [2]
S-1706	.1925 [2]
S-1707	.1800 [2]
S-1709	.1775 [2]
S-1712	.1775 [2]
S-1801	.1700 [2]

Butadiene-Styrene (Cont'd)

S-2000	.2275 [2]
S-2101	.2250 [2]
Synpol 1000	.2410 [2]
Synpol 1001	.2410 [2]
Synpol 1002	.2435 [2]
Synpol 1006	.2410 [2]
Synpol 1007	.2425 [2]
Synpol 1009	.2475 [2]
Synpol 1012	.2425 [2]
Synpol 1013	.2500 [2]
Synpol 1061	.2410 [2]
Synpol 1500	.2410 [2]
Synpol 1502	.2410 [2]
Synpol 1551	.2410 [2]
Synpol 1703	.2060 [2]
Synpol 1707	.1910 [2]
Synpol 1708	.1950 [2]
Synpol 1711	.1900 [2]

Butyl Rubbers

Enjay Butyl 035	.2300 [2]
Enjay Butyl 150	.2300 [2]
Enjay Butyl 165 NS	.2400 [2]
Enjay Butyl 215	.2300 [2]
Enjay Butyl 217	.2300 [2]
Enjay Butyl 218	.2300 [2]
Enjay Butyl 268 NS	.2400 [2]
Enjay Butyl 325	.2300 [2]
Enjay Butyl 365 NS	.2400 [2]
Polysar Butyl 100	.2450 [2]
Polysar Butyl 101	.2275 [2]
Polysar Butyl 200	.2450 [2]
Polysar Butyl 300	.2450 [2]
Polysar Butyl 301	.2550 [2]
Polysar Butyl 400	.2450 [2]

Neoprene

	(prices l.c.l.)
Neoprene Types AC and CG	.5500 [2]
Neoprene Type GN	.4100 [2]
Neoprene Type GN-A	.4100 [2]
Neoprene Type GRT	.4200 [2]
Neoprene Type KNR	.7500 [2]
Neoprene Type S	.4200 [2]
Neoprene Type W	.3900 [2]
Neoprene Type WHV	.3900 [2]
Neoprene Type WRT	.4500 [2]
Neoprene Type WX	.4100 [2]

Silicone Rubbers*

	(prices l.c.l.)
GE (compounded)	2.50 [2]
GE Silicone Gum (not compounded)	4.00 [2]
Silastic (compounded)	1.90 [2]
Union Carbide (gums)	4.00 [2]
Union Carbide (compounds)	2.50 [2]

Polysulfide Rubbers

	(prices l.c.l.)
Thiokol Type A	.4700 [2]
Thiokol Type FA	.6400 [2]
Thiokol PR-1	.9500 [2]
Thiokol Type ST	1.00 [2]

(latices—all prices per pound dry weight)

Butadiene-Acrylonitrile Types

Butaprene N-300	.4600 [1]
Butaprene N-400	.5400 [1]
Butaprene N-401	.5400 [1]
Chemigum 200	.4900 [2]
Chemigum 235	.5400 [2]
Chemigum 236	.5400 [2]
Chemigum 245	.4600 [2]
Chemigum 246	.4600 [2]
Hycar 1512	.4600 [2]
Hycar 1551	.5400 [2]
Hycar 1552	.4600 [2]
Hycar 1561	.5400 [2]
Hycar 1562	.4600 [2]
Hycar 1571	.5900 [2]
Hycar 1572	.5100 [2]
Hycar 1577	.4600 [2]

Butadiene-Styrene Types

Copo 2101	.2800 [2]
Copo 2102	.3100 [2]

Butadiene-Styrene (Cont'd)

Copo 2105	.3100 [2]
Copo X-765	.2900 [2]
FR-S 2000	.2600 [2]
FR-S 2001	.2600 [2]
FR-S 2002	.2850 [2]
FR-S 2003	.2950 [2]
FR-S 2004	.2950 [2]
FR-S 2006	.2600 [2]
FR-S 2105	.3100 [2]
Pliolite 2101	.3000 [2]
Pliolite 2104	.3200 [2]
Pliolite 2105	.3200 [2]
Pliolite X-765	.3000 [2]
Naugatex 2000	.2630 [2]
Naugatex 2001	.2630 [2]
Naugatex 2002	.2880 [2]
Naugatex 2005	.3000 [2]
Naugatex 2006	.2630 [2]
Naugatex 2101	.2850 [2]

Butadiene-Styrene (Cont'd)

Naugatex 2105	.3120 [2]
Naugatex X-767	.3230 [2]
S 2004	.2600 [2]

Neoprene

Neoprene Latex 60	.4000 [2]
Neoprene Latex 571	.3700 [2]
Neoprene Latex 572	.3900 [2]
Neoprene Latex 601-A	.4000 [2]
Neoprene Latex 735	.3800 [2]
Neoprene Latex 736	.3800 [2]
Neoprene Latex 842-A	.3700 [2]
Neoprene Latex 950	.4700 [2]

Polysulfide Rubbers

Thiokol Type MX	.7000 [2]
Thiokol Type WD-2	.9200 [2]
Thiokol Type WD-6	.7000 [2]

Notes: (1) Freight allowed. (2) Freight extra. (3) Freight prepaid. * Covers a wide range of compounds. Readers are urged to check specific prices with producers.

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- Reinforced Plastics
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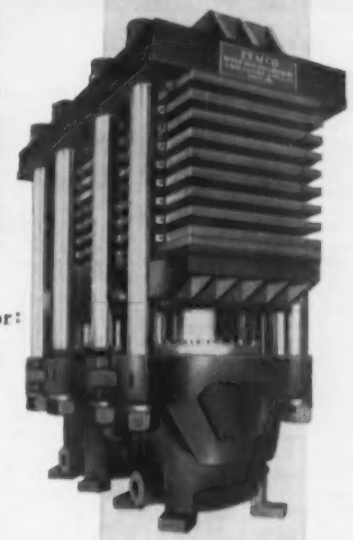

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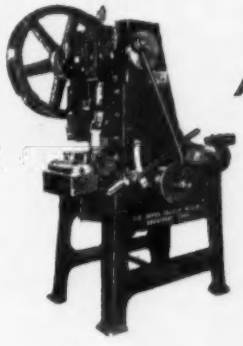

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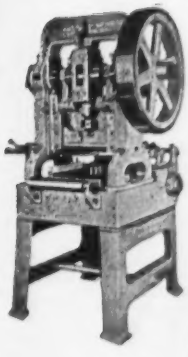
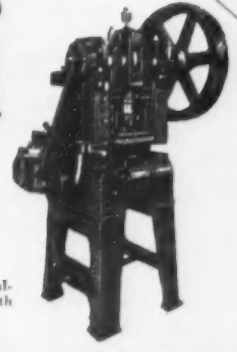
Precision cutting for both high-speed production or short runs.



MODEL A2 ▶
Precision cutting for multiple heels, half and full soles with stock grain.

MODEL A2s
(not illustrated)
Precision cutting across grain of stock.



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Precision cutting of multiple heels and taps with or across stock grain.

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BRIDGEPORT CONNECTICUT

MARKETS

(continued)

Reclaimed Rubber

Estimates by the Rubber Manufacturers Association indicate that 219,187 long tons of reclaimed rubber were produced in the United States in the first nine months of the current year. It is also estimated that 135 long tons of reclaim were imported during the period, and 10,082 long tons exported, making for a net new supply of 208,520 long tons. RMA states that during this same period, 205,026 long tons of reclaimed rubber were consumed, and there were said to be 35,301 long tons of reclaim on hand.

Earlier this year it was estimated in many quarters that 1956 consumption of reclaim would hit approximately 320,000 long tons. It now appears as if these estimates were a little sanguine. If consumption continues at the present rate, consumption figures for the year will approximate 280,000 long tons, or a drop of about 40,000 tons. It may be that increased automobile production in the balance of this year may bring total consumption closer to earlier estimates.

(Prices for All Areas Except Calif.)

	per lb.
Premium Grade Whole Tire	.11
First Line Whole Tire	.10½
Second Line Whole Tire	.10
Third Line Whole Tire	.09¼
Fourth Line Whole Tire	.09¼
Black Carcass	.14¾
No. 1 Light Colored Carcass	.20¾
No. 1 Peel	.11
Butyl Tube Reclaim	.14
Natural Rubber Black Tube	.15
Natural Rubber Red Tube	.21
Natural Rubber Gray Tube	.21

Scrap Rubber

Activities in the scrap rubber market continue on the dull side with sales generally described as being of a routine nature. Dealers were expecting increased automobile tire requirements for November, but there hasn't been too much interest shown in casings. Trading currently taking place is confined chiefly to scrap tubes, with demand noted for black and synthetic butyl rubber tubes.

Indications are that the anticipated demand for reclaimed rubber by the automotive industry in the fourth quarter of this year had not yet materialized to any great extent. Under these circumstances, the scrap rubber market can do little else but bide its time and await further developments. Current scrap rubber prices follow:

(Prices Delivered Akron)

Mixed tires	ton	15.00
Light colored carcass	lb.	.05½
No. 1 peelings	ton	45.00
No. 2 peelings	ton	30.00
No. 3 peelings	ton	21.00
Buffings	ton	16.00
Truck and Bus S.A.G.	ton	20.00
Passenger S.A.G.	ton	17.50
Natural Rubber Red Tubes	lb.	.07½
Natural Rubber Black Tubes	lb.	.06½
Butyl Rubber Tubes	lb.	.04

Tire Fabrics

News from the tire fabrics field took many different forms during the past month. First came an announcement from the Chemstrand Corp. that it was increasing the production capacity of its nylon plant at Pensacola, Fla., to 114,000,000 pounds per year. Company officials pointed out that the capacity increase was planned primarily to meet the growing demand for nylon yarn in tire cord and industrial uses.

Next came an announcement from the Industrial Rayon Corp. that it was cutting the price on two 1650 denier rayon tire yarns by three cents a pound with the cuts effective November 1. At this writing, other companies have not announced their position.

Vinyl Fabric Use Growing

The president of the Vinyl Fabric Institute reports that to date the year 1956 has been very satisfactory for the vinyl fabrics industry although no sensational gains were made. Reduced production of automobiles this year has not hurt vinyl fabric sales to the automotive industry as much as one might think, he said. This is because every year a larger quantity of vinyl fabric is being used in every automobile made.

Another major market for vinyl fabrics is the covering field. Vinyl fabrics are finding increased use in coverings for luggage, radios, television sets, tape recorders, typewriters and other office machines. These markets have all been very strong this year and gains have been recorded.

An official of the Boston Woven Hose & Rubber Co. notes that the textile industry has become aware of the potentialities of synthetic fibers in the manufacture of rubber products other than tires.

From the technical viewpoint, he said, synthetic fibers have replaced cotton in many applications because of their greater strength, flexibility, desirable stretch characteristics, better fastening and durability. Thus, rayon has replaced cotton in many constructions of hose and belting, and the newer nylon and Dacron are in turn replacing rayon for some products because of their still greater strength and durability.

Rayon Holds Vital Role

A vice-president of the American Viscose Corp. has reported that tire manufacturers consumed about 41% of all domestic rayon fibers in the production of more than 100,000,000 tires last year. It is expected, he said, that rayon will continue to be the leading fiber for passenger car tires.

(Prices f.o.b. Shipping Point)

Rayon Tire Cord

1100	lb.	.76
1650	lb.	.70
2200	lb.	.70½

Nylon Tire Cord

210	lb.	1.95
840	lb.	1.80

Rayon Graded Fabric

1100	lb.	.72
1650	lb.	.66½
2200	lb.	.66

Cotton Chafers

14.4 oz. (per square yard)	lb.	.73
9.25 oz. (per square yard)	lb.	.68
11.65 oz. (per square yard)	lb.	.64
8.9 oz. (per square yard)	lb.	.70

Liquid Latex

Natural: According to the Rubber Manufacturers Association, 55,276 long tons of natural rubber latex were imported into the United States in the first nine months of the current year. Of this total, 2,032 long tons were re-exported, leaving a net new supply of 53,244 long tons. RMA estimates that a total of 52,392 long tons of natural rubber latex were consumed in the first nine months of this year, and as of September 30 there were 14,983 long tons on hand.

Natural rubber latex is currently being quoted at 42½c per pound in tank car lots at East Coast ports. What with current difficulties in the Far and Middle East, and the rising price for RSS, most in the trade are loath to predict what may lie ahead. Under these conditions, a day-to-day procedure seems to be in order.

Synthetic: GR-S type latex is currently being produced in the United States at an average rate of about 5,600 long tons a month. Were this rate to continue for the balance of the year, total production for 1956 would be in the neighborhood of 67,000 long tons, or only about 1,500 long tons less than in the previous year.

Consumption of GR-S type latex, on the other hand, is currently running at an average rate of about 5,100 long tons a month. Were this average rate of consumption to continue for the balance of the year, 1956 consumption would be about 61,000 long tons, about 3,000 tons less than in 1955.

Natural latex stocks in the United States are sufficient for an average 3-month supply. If difficulties arise in the importation of natural latex because of the Suez situation, greater demands may be placed upon synthetic latex and the statistical picture would be adjusted accordingly.

Cotton

The price of middling uplands on the New York Cotton Exchange has moved in the exceedingly small range of 30 points since our last report (September 30), high for the period being 34.60c reached on October 3, and low being 34.30c reached on October 18. The average price of middling uplands for the month of October was 34.45c based upon 22 trading days. This compares with an average of 34.35c in September.

According to the Textile Economics Bureau, world production of commercial raw cotton in the 1956 season amounted to 37,700,000 bales, an increase of 700,000 bales or 2% over the previous year. This established the largest world production figure on record. The increase from the 1955 season to the current season comprised a gain of 1,000,000 bales in United States output and a net 300,000 bale decrease in cotton output by all foreign countries.

The position of the United States as the world's leading producer of cotton is shown by the fact that 39% of all the cotton produced in the world during the past season was grown in the United States. This compares with 37% in the previous season and 54% in the two seasons ending in 1949 and 1950.

The decline in U. S. percentage of world production is attributed to two factors. First, is the decline that has taken place in U. S. crop production in the last few years, most of which can be attributed directly to acreage restrictions that have been put into effect. Second, is the sizable increase in the output of foreign cotton since the end of World War II.

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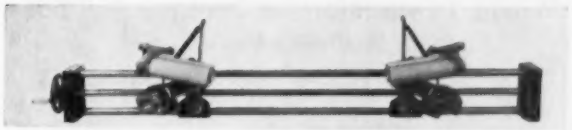

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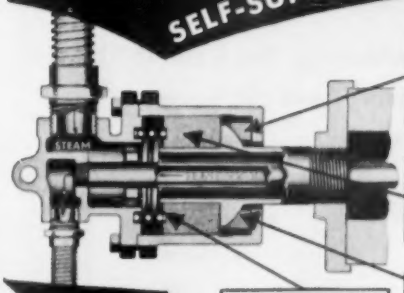

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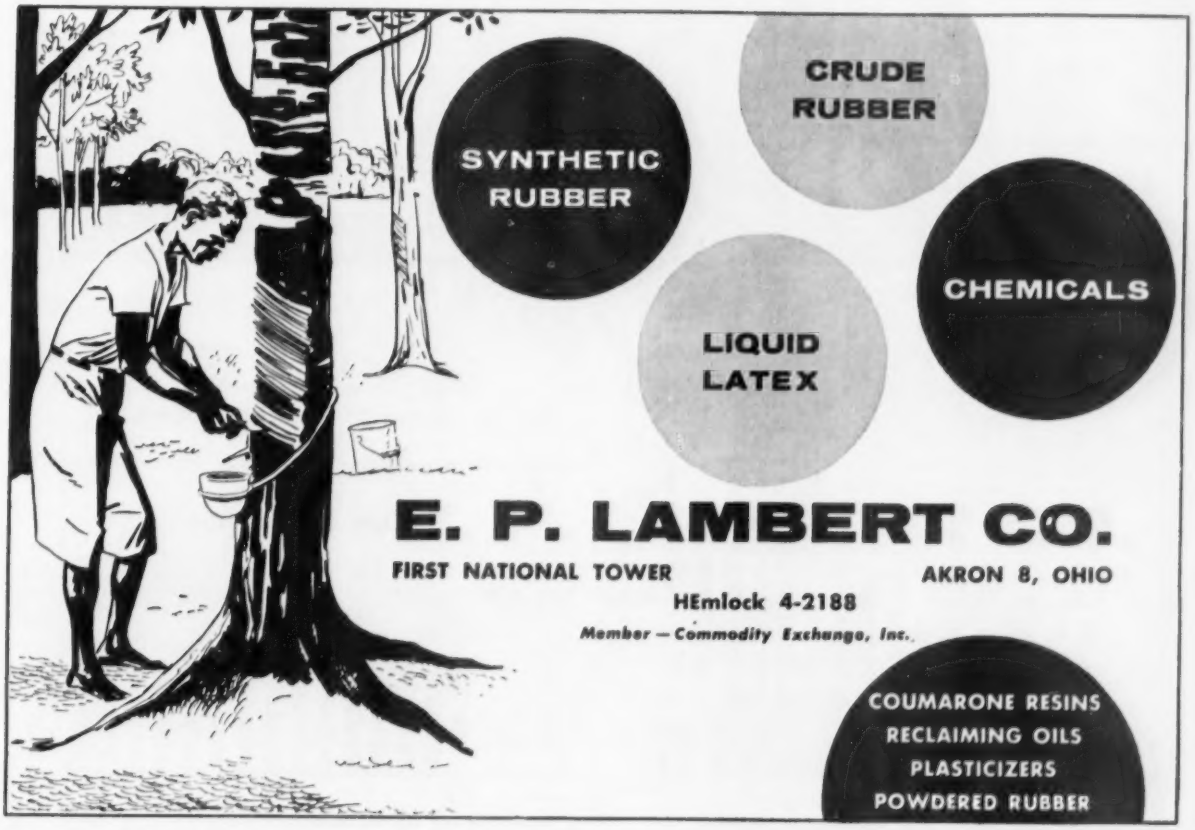

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CHEMICALS

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FIRST NATIONAL TOWER **AKRON 8, OHIO**

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COUMARONE RESINS
RECLAIMING OILS
PLASTICIZERS
POWDERED RUBBER

STATISTICS of the industry

PERTINENT INDUSTRY DATA

Natural Rubber in the United States

(Including Latex and Guayule)

(All Quantities in Long Tons)

Year	New Supply	Consumption	Re-Exports	Stocks On Hand at End of Period
1931	501,788	355,200	25,609	322,000
1932	414,668	336,700	20,937	379,000
1933	418,902	412,400	20,576	365,000
1934	463,018	462,500	23,856	355,000
1935	467,146	495,500	11,391	303,000
1936	488,145	575,000	12,582	223,000
1937	600,479	543,600	7,902	262,204
1938	411,983	437,031	5,652	231,500
1939	499,473	592,000	13,125	125,800
1940	818,243	648,500	7,060	288,864
1941	1,029,007	775,000	5,376	533,344
1942	282,653	376,791	10,856	422,714
1943	55,329	317,634	20,815	139,594
1944	107,834	144,113	9,665	93,650
1945	135,672	105,429	6,743	118,715
1946	400,687	277,597	4,338	237,467
1947	688,354	562,661	4,101	129,038
1948	735,227	627,332	6,673	141,541
1949	660,792	574,522	6,253	106,619
1950	802,249	720,268	8,644	89,215
1951	733,048	454,015	2,603	76,569
1952	805,997	453,846	3,024	95,260
1953	647,150	553,473	8,376	112,316
1954	596,848	596,285	7,443	104,543
1955	635,174	634,800	10,611	110,105
1955:				
July	43,626	46,166	906	105,782
Aug.	59,840	48,359	810	109,056
Sept.	50,459	50,963	980	113,185
Oct.	45,720	54,995	869	110,795
Nov.	50,509	52,769	1,102	103,764
Dec.	50,556	48,565	986	109,854
1956:				
Jan.	58,803	53,374	1,877	111,943
Feb.	53,353	50,285	752	111,832
Mar.	52,749	50,040	505	108,974
Apr.	51,394	47,446	731	109,822
May	39,789	48,342	753	107,324
June	36,694	42,845	865	101,748
July	41,195	38,353	712	103,301
Aug.	.....	46,091	.....	97,967

Source: U. S. Department of Commerce.

U. S. Imports of Natural Rubber

Year	Dry: Long Tons	Dry: Declared Value	Latex: Long Tons	Latex: Declared Value	Total Imports
1935	453,134	115,299,448	13,553	3,782,222	466,687
1936	467,064	152,072,496	19,852	6,659,899	486,916
1937	574,600	237,307,041	23,185	10,213,670	597,785
1938	397,640	125,373,864	11,944	4,168,127	409,584
1939	469,946	167,586,780	27,437	10,467,552	497,383
1940	781,202	303,308,823	33,789	14,593,466	814,991
1941	989,498	401,976,317	34,797	15,965,627	1,024,245
1942	266,276	112,537,426	10,646	5,630,667	276,922
1943	50,358	31,369,198	1,890	1,312,202	52,248
1944	103,847	73,908,549	3,091	2,092,211	106,938
1945	134,408	95,814,102	4,773	3,115,853	139,181
1946	376,502	228,796,110	8,421	5,843,085	384,923
1947	691,087	306,951,814	17,542	9,787,722	708,629
1948	702,293	290,849,177	32,745	18,288,223	735,038
1949	630,808	225,343,624	29,743	14,968,650	660,551
1950	747,109	416,222,598	54,401	41,764,486	801,510
1951	677,874	727,343,348	54,963	80,178,309	732,837
1952	756,987	578,179,519	48,228	40,563,116	805,215
1953	571,635	284,909,233	75,511	46,353,333	647,146
1954	522,364	219,098,143	74,483	42,755,029	596,847
1955	542,507	360,435,303	92,825	80,163,114	635,332
1955:					
July	34,924	21,653,274	8,702	6,855,619	43,626
Aug.	50,954	32,782,273	8,886	7,071,971	59,840
Sept.	42,350	29,854,781	8,108	7,902,094	50,458
Oct.	38,820	30,746,494	6,900	7,539,732	45,720
Nov.	43,423	34,989,275	7,085	8,063,930	50,508
Dec.	41,759	34,512,483	6,436	6,853,858	48,195
1956:					
Jan.	48,476	38,397,341	10,328	10,355,488	58,804
Feb.	45,682	35,983,385	7,670	7,814,076	46,449
Mar.	44,947	35,238,125	7,791	7,507,686	52,738
Apr.	44,443	31,826,631	6,996	6,369,348	51,439
May	34,058	22,579,829	5,731	4,782,907	39,789
June	31,687	19,375,943	5,006	3,732,281	36,693
July	37,673	22,164,793	3,522	2,539,365	41,195

Source: Bureau of the Census, U. S. Department of Commerce.

World Production of Natural Rubber

(Including Latex)

(Long Tons)

Year	Malaya	Indonesia	Ceylon	Viet Nam & Cambodia	Latin America	Rest of World*	Total*
1944	25,000*	50,000*	98,500	60,419	49,946	77,000	360,000
1945	8,600*	10,000*	97,500	12,000*	47,125	73,570	250,000
1946	403,719	175,000*	94,000	19,975	39,678*	105,080	837,500
1947	646,362	277,951	89,000	38,128	34,928*	172,782	1,260,000
1948	698,189	432,349	95,000	43,935	29,158*	225,557	1,525,000
1949	671,503	432,996	89,500	43,010	27,318*	225,659	1,490,000
1950	694,090	696,472	113,500	48,482	26,902*	280,299	1,860,000
1951	605,346	814,406	105,000	52,136	29,777*	278,262	1,885,000
1952	584,238	750,494	96,500	63,134	35,475*	261,211	1,790,000
1953	574,390	692,164	98,610	74,545	35,318*	250,182	1,725,000
1954	584,435	738,670	93,935	78,024	26,833*	280,112	1,802,500
1955	639,128	733,786	93,830	80,172	6,000*	344,584	1,897,500
1956:							
Jan.	59,085	41,441	9,015	9,829	2,941*	27,689	150,000
Feb.	51,497	44,427	4,578	2,217	2,536*	29,745	135,000
Mar.	51,023	38,413	5,179	3,054	2,921*	29,410	130,000
Apr.	48,394	66,164	6,678	5,117	3,447*	25,200	155,000
May	43,224	56,369	7,156	7,222	500*	23,029	137,500
June	52,653	47,831	6,537	....	500*	37,479	145,000
July	54,685	62,715	10,503	....	500*	34,097	162,500

Source: International Rubber Study Group. * Estimated.

World Consumption of Natural and Synthetic Rubber

(Including Latex)

(Long Tons)

Year	United States	United Kingdom	Canada	Europe*	Rest of World*	Total*
1944	710,783	86,977	34,310	132,500	160,690	1,125,000
1945	799,009	91,047	41,836	87,500	108,164	1,127,500
1946	1,039,296	126,770	39,196	145,000	115,804	1,467,500
1947	1,122,327	156,399	61,452	242,500	153,548	1,735,000
1948	1,069,404	196,286	62,121	392,000	182,379	1,902,500
1949	988,903	186,622	56,362	446,500	207,388	1,887,500
1950	1,258,557	222,425	68,695	448,500	287,055	2,285,000
1951	1,214,298	238,101	70,809	476,500	314,941	2,312,500
1952	1,261,413	202,179	67,099	550,000	254,901	2,335,000
1953	1,338,309	211,453	73,394	521,000	343,606	2,500,000
1954	1,233,012	247,612	71,656	544,250	408,094	2,505,000
1955	1,529,699	266,804	84,528	614,250	480,000	2,980,000
1955:						
Dec.	131,653	24,913	7,718	73,250	37,466	275,000
1956:						
Jan.	132,231	24,819	7,330	58,750	39,370	262,500
Feb.	125,525	20,993	7,480	64,250	36,752	255,000
Mar.	127,928	19,127	7,367	68,250	32,328	255,000
Apr.	122,128	21,991	7,963	59,000	41,418	252,500
May	124,738	17,670	8,157	68,750	33,185	252,500
June	111,454	19,698	7,658	.....	108,690	247,500
July	95,226	17,565	6,831	.....	102,878	222,500

Source: International Rubber Study Group. * Estimated.

Rim Production

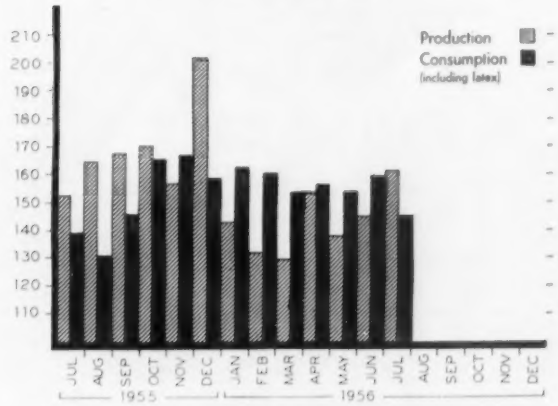
	1951	1952	1953	1954	1955
Passenger Car	29,145,367	24,936,844	31,318,461	25,952,322	38,092,080
Truck & Bus	6,877,419	5,752,674	5,228,321	4,463,689	6,642,329
Agricultural	3,019,581	2,073,116	1,943,487	1,297,040	1,931,768
Earth Mover	28,026	31,791	24,685	21,536	38,859
Total	39,070,393	32,794,425	38,514,954	31,734,587	46,705,036

	1956					
	Apr.	May	June	July	Aug.	Sept.
Passenger Car	2,386,695	2,142,707	1,815,678	1,795,980	1,662,478	1,503,720
Truck & Bus	532,293	621,532	645,770	447,592	444,204	549,760
Agricultural	108,515	98,856	144,007	83,413	79,190	80,379
Earth Mover	6,562	3,802	7,628	9,200	4,338	12,740
Total	3,034,065	2,866,897	2,613,083	2,336,185	2,190,210	2,146,599

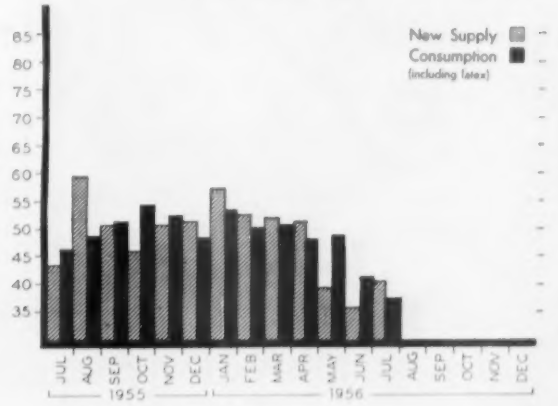
Source: The Tire & Rim Association, Inc.

STATISTICS at a glance

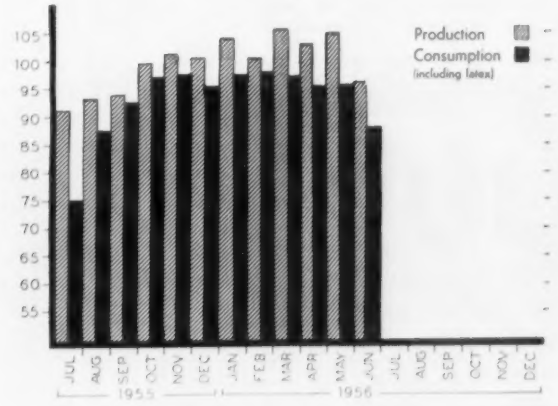
NATURAL RUBBER—WORLD
(thousands of long tons)



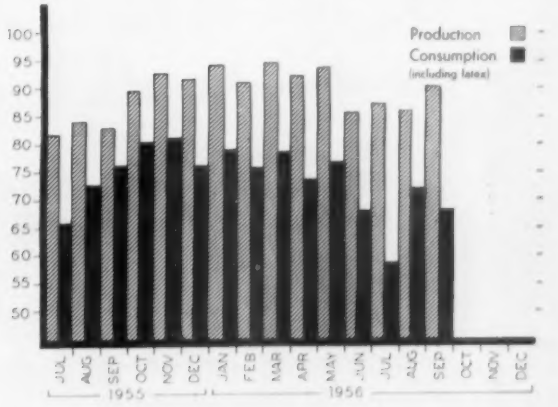
NATURAL RUBBER—UNITED STATES
(thousands of long tons)



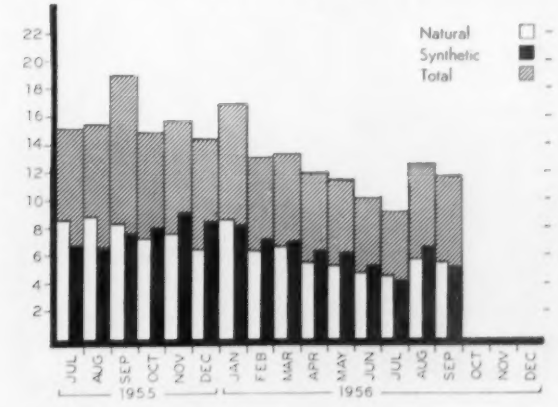
SYNTHETIC RUBBER—WORLD
(thousands of long tons)



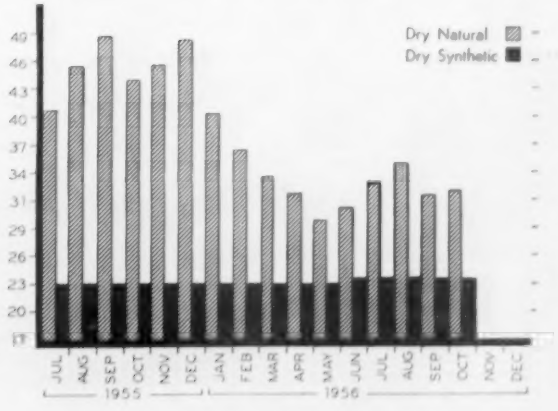
SYNTHETIC RUBBER—UNITED STATES
(thousands of long tons)



LATEX CONSUMPTION—UNITED STATES
(thousands of long tons)



PRICES—NATURAL AND SYNTHETIC
(cents per pound)



Synthetic Rubber in the United States

(All Quantities in Long Tons)

New Supply

Year	GR-S	Neoprene	Butyl	N-Type	Total
1949	310,599	35,215	54,046	11,072	410,932
1950	378,887	50,067	60,915	12,037	501,906
1951	704,529	58,907	76,475	15,333	855,244
1952	654,854	65,745	81,630	16,228	818,447
1953	680,728	80,495	79,801	20,198	861,222
1954	490,405	69,150	58,802	21,396	639,753
1955	801,145	91,357	56,179	32,623	982,304
1955:					
Nov.	75,745	8,537	4,935	2,931	92,148
Dec.	74,794	8,455	4,710	3,068	91,027
1956:					
Jan.	76,028	8,207	6,896	3,125	94,256
Feb.	73,457	8,560	6,229	2,989	91,235
Mar.	77,812	7,822	5,686	3,663	94,983
Apr.	74,502	8,481	5,685	3,648	92,316
May	78,309	7,795	5,647	2,903	94,654
June	69,820	8,929	4,638	2,350	85,737
July	70,831	7,935	7,192	2,460	88,418
Aug.	70,122	7,769	7,118	2,125	87,134
Sept.	72,778	8,321	7,219	2,009	90,327

Consumption

1949	321,137	31,753	52,664	8,827	414,381
1950	416,230	43,781	66,348	11,930	538,289
1951	626,444	48,887	70,500	13,066	758,897
1952	666,420	55,522	71,229	13,866	807,037
1953	624,181	65,900	77,826	16,929	784,836
1954	500,345	57,203	61,464	17,715	636,727
1955	741,997	72,876	53,991	26,035	894,899
1955:					
Nov.	68,111	6,896	4,420	2,234	81,661
Dec.	63,137	6,496	4,197	2,113	75,943
1956:					
Jan.	65,375	6,684	4,223	2,198	78,480
Feb.	62,366	6,430	4,155	2,289	75,240
Mar.	64,458	6,542	4,515	2,373	77,888
Apr.	62,179	6,125	4,228	2,150	74,682
May	63,629	6,379	4,285	2,103	76,396
June	56,390	5,536	4,026	1,864	67,816
July	48,907	4,435	3,316	1,538	58,196
Aug.	59,756	6,554	4,102	2,125	72,537
Sept.	56,488	5,990	4,005	2,009	68,492

Exports

1949	1,401	3,330	178	1,574	6,483
1950	900	4,826	31	1,895	7,652
1951	483	6,825	216	1,725	9,249
1952	9,467	9,813	126	2,695	22,101
1953	7,692	11,494	237	3,245	22,668
1954	11,069	12,062	2,831	4,155	30,117
1955	60,704	18,098	9,895	4,593	93,290
1955:					
Nov.	7,786	1,824	894	306	10,810
Dec.	7,837	1,786	968	375	10,966
1956:					
Jan.	7,550	1,757	815	506	10,628
Feb.	9,018	1,521	1,624	449	12,612
Mar.	10,804	1,500	764	522	13,590
Apr.	10,271	1,917	374	587	13,149
May	10,864	2,142	743	443	14,192
June	9,310	2,088	746	548	12,692
July	9,038	1,994	523	433	11,988
Aug.	9,607	2,268	654	274	12,803

Stocks

1949	77,731	4,654	12,224	3,433	98,042
1950	36,942	5,733	7,243	2,840	52,758
1951	105,271	8,379	12,481	3,821	129,912
1952	83,861	8,535	22,716	3,875	118,987
1953	135,153	11,480	24,866	4,346	175,845
1954	115,499	11,349	19,267	4,280	150,395
1955	108,989	12,220	10,500	6,030	137,739
1955:					
Nov.	105,287	11,530	11,646	5,201	133,664
Dec.	108,136	11,971	10,223	5,300	135,630
1956:					
Jan.	111,263	11,850	12,303	6,316	141,732
Feb.	114,389	11,888	13,027	6,602	145,906
Mar.	118,063	12,037	13,458	7,437	150,995
Apr.	121,054	12,042	14,071	8,243	155,410
May	127,163	11,478	15,253	8,788	162,682
June	133,570	12,927	15,744	2,086	164,327
July	145,601	15,084	18,899	2,009	181,593
Aug.	148,176	14,540	21,267	8,503	192,486
Sept.	153,910	13,843	23,268	7,990	199,011

Source: U. S. Department of Commerce.

Natural and Synthetic Rubber Latex in the United States

(All Quantities in Long Tons)

New Supply

Year	Natural	GR-S	Neoprene	N-Type	Total Synthetic	Grand Total
1944	3,090	6,580	4,683	.....	11,263	14,353
1945	4,768	15,176	7,077	.....	22,253	27,021
1946	8,012	24,810	13,595	.....	38,405	46,417
1947	17,675	22,474	6,089	.....	28,563	46,238
1948	32,630	21,494	5,022	.....	26,516	59,146
1949	29,974	21,357	3,651	.....	25,008	54,982
1950	54,401	31,339	5,725	.....	37,064	91,465
1951	54,963	32,972	6,866	2,948	42,786	97,749
1952	48,228	42,273	7,598	4,164	54,035	102,263
1953	75,511	48,112	9,026	5,844	62,982	138,493
1954	74,483	48,379	8,214	6,866	63,459	137,942
1955	92,754	69,364	10,432	10,798	90,594	183,348
1955:						
Aug.	8,885	4,456	881	917	6,254	15,139
Sept.	8,109	5,698	994	1,086	7,778	18,887
Oct.	6,900	6,231	922	883	8,036	14,936
Nov.	7,085	6,933	1,004	781	8,718	15,803
Dec.	6,018	6,407	962	874	8,243	14,261
1956:						
Jan.	10,328	6,885	848	919	8,652	18,890
Feb.	7,965	6,943	930	827	8,700	16,665
Mar.	7,800	5,911	782	1,158	7,851	15,651
Apr.	6,995	6,066	969	866	7,901	14,896
May	5,731	4,966	939	614	6,519	12,250
June	5,006	4,776	907	543	6,226	11,232
July	3,522	4,241	444	731	5,416	8,938
Aug.	4,715	4,902	882	684	6,468	11,183
Sept.	....	5,651	1,180	938	7,769	7,769

Consumption[1]

1944	6,085	6,000	4,400	....	10,400	16,485
1945	3,886	14,500	6,800	....	21,300	25,186
1946	5,714	23,500	13,000	....	36,500	42,214
1947	13,909	22,500	6,500	....	29,000	42,909
1948	28,489	21,500	5,250	....	26,750	55,239
1949	36,117	21,500	3,750	....	25,250	61,367
1950	56,138	31,000	5,500	....	36,500	92,638
1951	46,750	31,031	6,279	2,628	39,938	86,688
1952	53,567	40,562	7,368	3,093	51,023	104,590
1953	67,375	46,473	7,981	3,654	58,108	125,483
1954	75,931	44,173	7,251	4,507	55,931	131,862
1955	86,478	63,982	8,736	8,495	81,213	167,691
1955:						
Aug.	6,784	4,514	770	810	6,094	12,878
Sept.	7,452	5,505	730	878	7,113	14,565
Oct.	7,209	5,704	739	614	7,057	14,266
Nov.	6,620	5,954	829	603	7,386	14,006
Dec.	6,473	5,719	768	538	7,025	13,498
1956:						
Jan.	6,776	5,858	772	670	7,300	14,076
Feb.	6,399	5,913	787	730	7,430	13,829
Mar.	6,438	5,888	729	781	7,398	13,836
Apr.	5,693	4,923	741	692	6,356	12,049
May	5,239	4,745	778	691	6,214	11,453
June	5,171	4,350	637	657	5,644	10,815
July	4,855	3,731	562	466	4,759	9,614
Aug.	6,374	5,055	816	698	6,569	12,943
Sept.	5,820	4,572	685	494	5,751	11,571

Stocks at End of Period

1944	2,443	....	....	....	....	2,443
1945	3,121	....	....	....	....	3,121
1946	4,865	....	....	....	....	4,865
1947	5,033	....	....	....	....	5,033
1948	11,235	....	....	....	....	11,235
1949	5,063	....	....	....	....	5,063
1950	4,927	....	....	....	....	4,927
1951	4,752	3,727	1,245	532	5,504	10,256
1952	6,201	5,040	1,019	902	6,961	13,162
1953	13,532	4,794	1,117	721	6,632	20,164
1954	11,133	5,134	1,087	811	7,032	18,165
1955	13,203	6,980	1,236	1,807	10,203	23,406
1955:						
Aug.	11,962	6,201	885	1,319	8,405	20,367
Sept.	12,595	6,448	975	1,527	8,950	21,545
Oct.	12,156	5,798	1,075	1,196	8,069	20,225
Nov.	12,616	6,307	1,089	1,174	8,570	21,186
Dec.	12,645	6,357	1,155	1,248	8,760	21,405
1956:						
Jan.	16,059	6,522	1,093	1,906	9,521	25,580
Feb.	16,735	7,011	1,162	1,943	10,116	26,851
Mar.	18,309	6,867	1,097	2,340	10,304	28,613
Apr.	21,384	7,415	1,163	2,272	10,850	32,234
May	21,234	7,516	1,218	2,194	10,928	32,162
June	21,033	7,447	1,328	2,086	10,861	31,894
July	19,952	7,288	1,109	2,009	10,406	30,358
Aug.	18,099	6,402	1,076	1,703	9,181	27,280
Sept.	14,944	6,340	1,269	1,057	8,666	23,610

Source: U. S. Department of Commerce.
Note: (1) GR-S and Neoprene consumption estimated through 1950.

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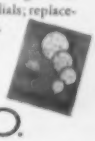

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Rubber Industry Employment Earnings and Hours

All Rubber Products

Mo.	1955 Production Workers (thousands)	1955 Average Weekly Earnings	1955 Average Weekly Hours	1955 Average Hourly Earnings	1956 Production Workers (thousands)	1956 Average Weekly Earnings	1956 Average Weekly Hours	1956 Average Hourly Earnings
Jan.	208.5	$83.84	41.3	$2.03	229.5	$87.91	40.7	$2.16
Feb.	209.4	84.25	41.3	2.04	224.5	85.81	40.1	2.14
Mar.	211.6	83.64	41.0	2.04	220.8	84.93	39.5	2.15
Apr.	210.9	86.53	41.8	2.07	218.7	85.79	39.9	2.15
May	215.7	87.36	42.0	2.08	216.0	86.18	39.9	2.16
June	219.0	88.83	42.3	2.10	208.5	84.93	39.5	2.15
July	215.7	86.32	41.3	2.09	207.3	86.37	39.8	2.17
Aug.	216.8	86.32	41.3	2.09	209.3	....	....	....
Sept.	223.1	86.74	41.5	2.09	....	....	....	....
Oct.	226.4	89.04	42.0	2.12	....	....	....	....
Nov.	231.2	92.01	42.4	2.17	....	....	....	....
Dec.	233.9	89.21	41.3	2.16	....	....	....	....

Tires and Tubes

Jan.	85.3	97.41	41.1	2.37	93.7	101.00	40.4	2.50
Feb.	86.5	96.46	40.7	2.37	93.2	97.71	39.4	2.48
Mar.	87.4	95.51	40.3	2.37	92.6	97.25	38.9	2.50
Apr.	88.6	102.18	42.4	2.41	91.8	98.00	39.2	2.50
May	89.8	101.88	42.1	2.42	91.6	99.65	39.7	2.51
June	91.0	105.60	43.1	2.45	90.1	98.25	39.3	2.50
July	91.5	103.33	42.7	2.42	89.2	98.39	39.2	2.51
Aug.	91.0	102.72	42.1	2.44	....	....	....	....
Sept.	91.9	101.02	41.4	2.44	....	....	....	....
Oct.	92.3	103.74	42.0	2.47	....	....	....	....
Nov.	94.2	106.26	42.0	2.53	....	....	....	....
Dec.	94.7	99.50	39.8	2.50	....	....	....	....

Rubber Footwear

Jan.	22.1	68.97	40.1	1.72	21.0	74.37	40.2	1.85
Feb.	21.5	69.72	40.3	1.73	20.9	74.74	40.4	1.85
Mar.	21.5	69.72	40.3	1.73	20.7	71.34	39.2	1.82
Apr.	21.3	70.82	40.7	1.74	20.3	72.25	39.7	1.82
May	21.3	70.07	40.5	1.73	20.0	72.25	39.7	1.82
June	21.6	71.34	41.0	1.74	19.4	70.53	39.4	1.79
July	21.8	70.99	40.8	1.74	18.9	71.28	39.6	1.80
Aug.	21.5	67.25	39.1	1.72	....	....	....	....
Sept.	23.5	67.60	39.3	1.72	....	....	....	....
Oct.	24.4	69.20	40.0	1.73	....	....	....	....
Nov.	25.5	77.89	42.1	1.85	....	....	....	....
Dec.	26.2	74.89	40.7	1.84	....	....	....	....

All Other Rubber Products

Jan.	101.1	76.08	41.8	1.82	114.8	79.73	41.1	1.94
Feb.	101.4	76.86	42.0	1.83	110.4	77.95	40.6	1.92
Mar.	102.7	76.49	41.8	1.83	107.5	76.99	40.1	1.92
Apr.	101.0	76.54	41.6	1.84	106.6	77.95	40.6	1.92
May	104.6	78.68	42.3	1.86	104.4	76.99	40.1	1.92
June	106.4	77.93	41.9	1.86	99.0	76.02	39.8	1.91
July	102.4	74.37	40.2	1.85	99.2	78.38	40.4	1.94
Aug.	104.3	75.85	41.0	1.85	....	....	....	....
Sept.	107.7	78.96	42.0	1.88	....	....	....	....
Oct.	109.7	80.56	42.4	1.90	....	....	....	....
Nov.	111.5	83.03	42.8	1.94	....	....	....	....
Dec.	113.0	83.69	42.7	1.96	....	....	....	....

Source: U. S. Department of Labor.

Note: Data are based upon reports from cooperating establishments covering both full and part-time employees who work during, or received pay for, any part of the pay period ending nearest the 15th of the month. These employment series have been adjusted to first quarter 1954 benchmark levels indicated by data from government social insurance programs. Hours and earnings data pertain only to production and related workers.

Spot Closing Cotton Prices

(Middling Upland Grade—New York Market—in Cents)

Average Monthly Price Per Pound

	1949	1950	1951	1952	1953	1954	1955	1956
Jan.	33.37	31.89	45.04	42.96	33.24	34.15	35.07	35.24
Feb.	33.41	32.79	(a)	41.64	33.76	35.00	35.04	36.26
Mar.	33.44	32.65	46.06	41.70	34.10	35.23	34.33	36.70
Apr.	33.84	33.23	46.06	41.79	33.85	35.22	34.23	36.81
May	33.73	33.64	46.06	39.98	34.30	35.34	34.80	36.65
June	33.56	34.61	46.06	41.31	34.11	35.17	34.83	36.67
July	32.99	38.11	46.21	40.37	34.20	35.37	34.61	35.43
Aug.	32.06	38.93	35.93	40.42	33.82	35.19	34.53	34.31
Sept.	30.94	41.62	36.20	39.75	33.69	35.46	33.85	34.35
Oct.	30.32	40.66	38.13	37.52	33.53	35.24	33.93	34.45
Nov.	30.52	43.11	42.70	35.59	33.60	34.80	34.87	....
Dec.	31.08	43.37	43.32	33.76	33.52	35.03	34.95	....
Average for Year	32.44	37.05	42.43	39.71	33.81	35.10	34.59	....

Note: The Government established a ceiling price of 45.76c for spot cotton on March 3, 1951. (a) Trading suspended during February.

Production Index for the Rubber Industry

(1947-1949 = 100)

(Based on man-hours)

	1954	1955	1956		1954	1955	1956
Jan.	114	145	147	July	85	137	117
Feb.	114	144	140	Aug.	94	138	130
Mar.	118	146	135	Sept.	118	142	...
Apr.	116	147	137	Oct.	132	147	...
May	121	146	131	Nov.	124	147	..
June	121	149	122	Dec.	128	144	...

Sales by the Rubber Industry

(in Millions of Dollars*)

	1954	1955	1956		1954	1955	1956
Jan.	361	424	415	July	393	471	459
Feb.	360	440	445	Aug.	352	456	...
Mar.	378	466	451	Sept.	346	456	...
Apr.	382	445	445	Oct.	346	447	...
May	378	465	464	Nov.	404	482	...
June	385	465	450	Dec.	417	465	...

Rubber Manufacturers' Inventories

(in Millions of Dollars*)

	1954	1955	1956		1954	1955	1956
Jan.	835	790	935	July	787	853	987
Feb.	848	782	970	Aug.	754	863	...
Mar.	844	805	979	Sept.	799	874	...
Apr.	813	784	970	Oct.	835	902	...
May	798	810	985	Nov.	811	935	...
June	817	850	975	Dec.	821	934	...

Source: U. S. Department of Commerce.
Notes: * Adjusted for seasonal variation.

No. 1 R.S.S.—Annual Average Prices

(New York Market—Cents per Pound)

Year	High	Low	Avg.	Year	High	Low	Avg.
1914	93	56	65.33	1935	13¾	10½	12.37
1915	79	58½	65.85	1936	23	13½	16.41
1916	102	55	72.50	1937	26⅜	14	19.39
1917	90	52	72.23	1938	17⅞	10¾	14.64
1918	70	40	60.15	1939	24	14⅛	17.57
1919	57	38½	48.70	1940	24	18¾	20.10
1920	56½	16	36.30	1941	24⅞	19⅛	22.40
1921	21¾	11½	16.36	1942	22½	22½	22.50
1922	28⅜	13⅜	17.50	1943	22½	22½	22.50
1923	37½	24¾	29.45	1944	22½	22½	22.50
1924	40⅝	17⅜	26.20	1945	22½	22½	22.50
1925	121	34⅜	72.46	1946	22½	22½	22.50
1926	88½	36¾	48.50	1947	25	14	20.00
1927	41¾	33	37.72	1948	25	18	21.99
1928	41¾	17	22.48	1949	19¾	15⅞	17.57
1929	26⅞	15½	20.55	1950	86	18	41.10
1930	16½	7½	11.98	1951	76	52	(a)
1931	8⅝	4⅛	6.17	1952*	33	26½	29.15
1932	4¾	2½	3.49	1953	31⅞	19⅞	24.21
1933	9⅞	2⅞	5.96	1954	34½	19½	23.61
1934	15⅞	8¾	12.92	1955	52	29⅜	39.16

Note: Price was fixed by Government on August 6, 1941, at 22½c a pound for non-war uses. Free trading was resumed May 1, 1947. (a) Free trading suspended March 31, 1951. GSA selling price ranged between 52 and 66c during balance of year. * Free trading was resumed on July 1, 1952; figures represent only July through December, 1952.

No. 1 R.S.S.—Monthly Average Prices

(New York Market—Cents per pound)

	1949	1950	1951	1952	1953	1954	1955	1956
Jan.	19.23	18.33	71.21	....	29.40	20.22	33.92	41.70
Feb.	18.49	19.40	73.61	....	27.57	19.98	34.90	36.46
Mar.	19.08	19.86	72.05	....	26.59	20.16	31.08	33.68
Apr.	18.53	23.51	....	....	24.66	22.06	31.75	31.74
May	17.92	28.07	....	....	25.52	21.96	31.35	29.61
June	16.36	30.92	....	....	24.42	23.01	34.74	30.54
July	16.45	39.10	....	30.52	23.64	24.12	40.84	33.91
Aug.	16.60	51.63	....	29.36	23.36	23.26	45.85	35.69
Sept.	17.58	55.98	....	27.42	23.06	23.99	48.27	32.64
Oct.	16.31	62.19	....	27.26	20.82	26.57	43.81	32.68
Nov.	16.70	73.05	....	29.25	20.58	28.07	44.95	....
Dec.	17.53	71.20	....	31.26	20.92	29.88	48.40	....
Average for Year	17.57	41.10	(*)	29.15	24.21	23.61	39.16	....

Note: (*) Free trading suspended March 31, 1951, and resumed on July 1, 1952.

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Automotive Pneumatic Casings

(Thousands of Units)

	Shipments					
	Original Equipment	Replacement	Export	Total	Production	Inventory End of Period
1946 (total)	15,310	65,490	1,512	82,312	82,298	2,448
Passenger Car	11,086	54,684	653	66,423	66,466	1,763
Truck and Bus	4,224	10,806	859	15,889	15,832	685
1947 (total)	25,056	62,871	3,256	91,183	95,550	6,949
Passenger Car	19,644	52,857	1,608	74,109	77,795	5,444
Truck and Bus	5,412	10,014	1,648	17,074	17,755	1,505
1948 (total)	26,845	49,148	1,787	77,781	81,314	10,698
Passenger Car	21,589	41,295	656	63,540	66,738	8,773
Truck and Bus	5,256	7,853	1,132	14,241	14,576	1,925
1949 (total)	31,584	43,466	1,467	76,517	76,369	10,638
Passenger Car	28,129	36,440	509	65,077	65,140	8,904
Truck and Bus	3,456	7,026	958	11,440	11,228	1,734
1950 (total)	41,349	56,808	1,430	99,587	92,754	3,794
Passenger Car	36,678	47,103	642	84,423	78,598	3,050
Truck and Bus	4,671	9,705	788	15,164	14,156	743
1951 (total)	32,153	44,612	1,677	78,442	83,405	8,765
Passenger Car	26,729	34,226	723	61,678	65,546	6,973
Truck and Bus	5,424	10,386	954	16,764	17,859	1,791
1952 (total)	29,484	54,342	1,520	85,346	90,411	14,110
Passenger Car	24,106	45,458	741	70,305	74,341	11,251
Truck and Bus	5,378	8,884	779	15,041	16,070	2,859
1953 (total)	37,949	55,124	1,543	94,617	96,150	15,720
Passenger Car	33,106	45,798	809	79,713	81,455	13,044
Truck and Bus	4,843	9,326	734	14,904	14,696	2,676
1954 (total)	33,333	55,155	1,753	90,241	89,141	14,762
Passenger Car	29,741	47,044	928	77,713	76,794	12,217
Truck and Bus	3,591	8,111	826	12,528	12,347	2,545
1955 (total)	47,374	59,246	1,879	108,499	112,178	18,778
Passenger Car	42,574	50,189	966	93,730	97,223	15,963
Truck and Bus	4,800	9,057	912	14,769	14,955	2,815
1955:						
Nov. (total)	4,303	3,592	150	8,045	9,603	17,727
Passenger Car	3,900	2,902	63	6,865	8,198	15,142
Truck and Bus	403	690	87	1,180	1,405	2,585
Dec. (total)	4,045	3,298	172	7,515	8,478	18,778
Passenger Car	3,641	2,746	80	6,467	7,223	15,963
Truck and Bus	404	552	91	1,047	1,255	2,815
1956:						
Jan. (total)	3,402	4,669	131	8,203	8,979	19,517
Passenger Car	2,958	4,040	66	7,064	7,661	16,546
Truck and Bus	444	629	65	1,139	1,318	2,971
Feb. (total)	3,342	3,952	178	7,473	8,897	20,933
Passenger Car	2,919	3,387	90	6,396	7,571	17,701
Truck and Bus	424	565	88	1,077	1,326	3,232
Mar. (total)	3,466	5,034	127	8,627	9,193	21,562
Passenger Car	3,027	4,372	65	7,464	7,812	18,096
Truck and Bus	439	662	62	1,163	1,382	3,465
Apr. (total)	3,217	5,761	141	9,119	8,834	21,132
Passenger Car	2,787	4,994	67	7,847	7,530	17,649
Truck and Bus	430	767	74	1,271	1,303	3,483
May (total)	2,770	5,980	130	8,880	8,986	21,296
Passenger Car	2,349	5,203	65	7,617	7,628	17,714
Truck and Bus	421	777	65	1,264	1,358	3,582
June (total)	2,533	6,627	129	9,289	7,929	19,947
Passenger Car	2,162	5,659	64	7,885	6,600	16,443
Truck and Bus	372	968	65	1,404	1,329	3,503
July (total)	2,833	6,319	145	9,298	6,741	17,394
Passenger Car	2,471	5,482	73	8,026	5,668	14,088
Truck and Bus	362	837	72	1,271	1,073	3,306
Aug. (total)	2,303	6,178	163	8,644	8,050	16,794
Passenger Car	1,953	5,359	77	7,389	6,897	13,578
Truck and Bus	349	819	86	1,254	1,153	3,217

Source: The Rubber Manufacturers Association, Inc.

Automobile Production in U. S.

(Civilian Production Only)

Year	Passenger Cars	Trucks	Total	Year	Passenger Cars	Trucks	Total
1936	3,669,528	781,862	4,451,390	1946	2,148,699	930,760	3,079,429
1937	3,915,889	892,382	4,808,271	1947	3,558,178	1,220,634	4,778,812
1938	2,000,985	485,852	2,486,837	1948	3,909,270	1,363,856	5,273,126
1939	2,866,796	704,308	3,571,104	1949	5,108,841	1,123,736	6,232,577
1940	3,692,328	721,637	4,413,965	1950	6,665,836	1,332,263	7,998,099
1941	3,744,500	875,381	4,619,681	1951	5,337,729	1,420,432	6,758,161
1942	220,814	133,083	353,897	1952	4,320,794	1,212,790	5,533,584
1943	0	4,501	4,501	1953	6,121,787	1,202,196	7,323,983
1944	0	124,819	124,819	1954	5,558,897	1,038,045	6,596,942
1945	83,792	313,643	397,435	1955	7,920,186	1,245,018	9,165,204
1955:							
Jan.	635,513	89,676	725,189	July	658,736	109,589	768,325
Feb.	677,705	67,061	744,766	Aug.	620,610	95,119	715,729
Mar.	791,280	102,992	894,272	Sept.	467,845	91,894	559,739
Apr.	753,434	127,887	881,321	Oct.	505,177	95,610	600,787
May	721,139	127,941	849,080	Nov.	745,993	114,448	860,441
June	647,658	119,215	766,873	Dec.	695,096	103,586	799,092
1956:							
Jan.	591,032	98,968	690,000	July	440,980	80,731	521,711
Feb.	560,924	102,384	663,308	Aug.	417,020	85,827	502,847
Mar.	583,169	106,379	689,548	Sept.	203,888	71,299	275,187
Apr.	552,881	101,081	653,962	Oct.	.....	.....	...
May	474,010	96,114	570,124	Nov.	.....	.....	.....
June	445,758	91,791	537,549	Dec.	.....	.....	.....

Source: Automobile Manufacturers Association.
Note: Figures are based on factory sales. Revisions are made from time to time in these figures and the latest issue should be consulted for accuracy.

Automotive Inner Tubes

(Thousands of Units)

	Shipments					
Year	Original Equipment	Replacement	Export	Total	Production	Inventory End of Period
1946	15,327	59,357	1,424	76,108	77,251	3,820
1947	25,046	46,560	2,483	74,088	79,181	8,059
1948	26,833	40,548	1,119	68,499	70,033	9,641
1949	31,521	31,450	887	63,858	65,114	10,657
1950	41,240	42,671	811	84,723	80,179	...
1951	32,151	32,284	1,071	65,507	67,249	10,094
1952	29,451	32,985	1,014	63,449	65,073	12,036
1953	37,957	36,072	878	74,907	74,425	11,874
1954	25,071	35,576	945	61,593	48,279	9,519
1955	5,001	33,387	1,001	39,389	35,900	6,833
1955:						
Dec.	305	2,289	93	2,686	2,719	6,833
1956:						
Jan.	273	3,263	71	3,608	2,917	6,294
Feb.	273	2,548	100	2,921	2,969	6,547
Mar.	281	2,587	93	2,962	3,347	6,848
Apr.	265	2,444	88	2,797	3,094	7,312
May	280	2,515	83	2,878	3,093	7,657
June	269	3,023	79	3,370	2,837	7,349
July	247	3,055	82	3,384	2,300	6,418
Aug.	242	2,954	99	3,295	2,795	5,962

Source: The Rubber Manufacturers Association, Inc.

Vinyl and Vinyl Copolymer Resins—Sales

(Thousands of Pounds—Resin Content)

	Polyvinyl Chloride and Copolymer Resins							All Other Vinyl Resins		
	Film	Sheeting	Molding & Extrusion	Textile & Paper Treating	Flooring	Protective Coatings	All Other Uses	Adhesives	All Other Uses	Grand Total
1953	63,691	62,385	129,215	52,353	22,152	22,823	27,790	22,411	77,478	480,299
1954	69,943	56,588	147,284	49,546	34,890	23,676	35,148	26,609	74,090	517,773
1955	83,276	51,424	183,736	64,223	56,357	27,439	53,868	31,853	105,644	657,821
1955:										
July	5,925	3,765	11,943	4,304	3,601	2,027	3,540	2,605	6,919	44,631
Aug.	6,478	3,359	13,265	5,136	4,599	2,105	4,759	2,868	8,799	51,367
Sept.	6,983	4,166	15,412	5,582	4,707	2,313	4,017	3,072	9,129	55,382
Oct.	7,498	4,581	16,067	6,043	5,369	2,290	6,318	2,670	9,836	60,672
Nov.	6,855	4,771	18,224	6,271	4,945	2,147	6,818	2,945	9,831	62,807
Dec.	6,273	4,585	16,682	6,089	4,214	1,980	5,458	2,190	10,087	57,558
1956:										
Jan.	6,496	4,928	16,842	6,176	5,181	2,289	6,584	3,331	10,628	62,455
Feb.	6,849	5,296	16,509	5,187	4,894	1,792	6,185	2,718	8,696	58,126
Mar.	7,388	5,280	16,965	4,962	5,016	2,274	5,811	3,162	9,364	60,222
Apr.	6,247	4,674	15,560	4,646	4,494	2,344	7,295	3,114	11,612	59,986
May	5,948	4,403	16,470	4,322	5,075	2,458	6,087	3,288	10,158	58,209
June	5,345	4,217	14,946	4,727	5,316	2,364	5,228	2,863	7,731	52,737
July	4,722	3,714	15,203	4,298	4,231	2,681	2,321	3,165	8,146	48,481
Aug.	6,497	4,787	17,490	5,727	6,798	2,416	7,228	3,256	9,213	63,412

Source: Chemical Division, U. S. Tariff Commission.

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Various Compounding Materials Consumed by the Rubber Industry

Material	1949	1950	1951	1952	1953	1954	1955
Antimony, Primary:							
Short tons	55	103[c]	19[c]	66[c]	20[c]	49[c]	45[c]
% of total	.005	.007	.001	.004	.001	.004	.004
Asphalt:[a]							
Short tons	18,050	26,819	21,414	33,288	.....	.....	.....
% of total	0.3	0.3	0.3	0.4	.....	.....	.....
Barite (Barytes):							
Short tons	14,000	19,000	15,000	18,000	21,000	20,000	.....
% of total	2.53	3.31	2.13	2.0	2.0	2.0	.....
Carbon Black:							
Short tons	383,565	515,184	530,614	537,273	566,797	511,813	.....
% of total	93.3	92.9	93.9	93.1	94.4	.....	.....
Clay, Kaolin:							
Short tons	197,341	263,306	231,331	240,982	241,052	247,431	.....
% of total	13.1	15.0	12.7	13.2	12.8	13.2	.....
Clay, Fire & Stoneware:							
Short tons	27,148	9,500	.....	9,322	18,475	8,781	.....
% of total	0.3	0.1	.....	0.1	.2	.1	.....
Lime:							
Short tons	715	908	1,126	2,000	1,631	1,555	.....
% of total	.0002	.0002	(d)	(d)	(d)	(d)	.....
Litharge:							
Short tons	1,398	3,047	2,641	2,109	2,230	1,768	.....
% of total	1.2	1.7	1.7	1.5	1.4	1.3	.....
Lithopone:							
Short tons	3,245	4,092	3,295	1,523	1,723	1,701	.....
% of total	4.1	3.9	3.2	2.5	3.3	3.9	.....
Mica, Ground:							
Short tons	3,856	5,776	6,551	5,126	5,668	5,021	.....
% of total	7.0	8.0	9.0	7.0	7.8	6.3	.....
Sulfur:							
Short tons	59,360	75,000	75,000	75,000	80,000	.....	.....
% of total	1.3	1.3	1.4	1.4	1.4	.....	.....
Talc:[b]							
Short tons	53,400	75,900	70,970	64,476	32,137	30,621	.....
% of total	12.0	12.0	11.2	10.9	0.7	.07	.....
Zinc Oxide:							
Short tons	58,496	82,944	71,507	72,774	78,439	71,058	.....
% of total	52.5	51.6	48.4	51.2	52.7	50.7	.....

Source: U. S. Bureau of Mines.
Notes: (a) Solid and semi-solid products of less than 200 penetration. (b) Includes prophyllite and ground soapstone. (c) Does not include precipitated antimony sulfide as in previous years. (d) Negligible.

Reclaimed Rubber

(Including Natural and Synthetic)

(All Quantities in Long Tons)

Year	New Supply	Consumption: Tons	Consumption: % to Crude[a]	Exports	Stocks On Hand at End of Period
1941	274,202	251,231	32.2	13,851	41,750
1942	286,007[b]	254,820	64.6	30,405	42,532
1943	304,058[c]	291,082	59.6	15,678	46,201
1944	260,631[d]	251,083	35.3	11,800	43,832
1945	243,309	241,036	30.2	13,413	28,155
1946	295,612	275,410	26.5	14,461	33,666
1947	291,395	288,395	24.8	14,556	35,943
1948	266,861	261,113	24.4	11,428	32,630
1949	224,029	226,679	22.5	10,637	28,263
1950	314,008	303,733	24.1	11,740	35,708
1951	366,700	346,121	26.6	14,722	45,082
1952	274,981	280,002	22.2	11,180	30,664
1953	298,336	285,050	21.3	11,597	32,319
1954	258,101	249,049	20.2	10,232	30,746
1955	326,649	312,781	20.4	13,988	31,498
1955:					
Aug.	25,223	25,790	21.2	1,144	27,956
Sept.	26,512	26,340	20.6	1,018	27,110
Oct.	28,038	26,597	19.7	1,381	27,565
Nov.	29,124	27,229	20.3	1,313	28,473
Dec.	28,153	24,604	20.0	1,347	31,100
1956:					
Jan.	26,205	25,827	19.6	1,382	31,640
Feb.	27,108	25,571	20.3	1,115	31,875
Mar.	28,468	26,176	20.3	1,163	33,326
Apr.	26,933	23,999	19.6	1,179	34,360
May	25,485	23,560	18.9	1,297	34,863
June	22,153	20,049	18.4	1,264	35,647
July	19,776	18,099	18.7	952	35,703
Aug.	21,724	21,498	18.0	1,076	35,512
Sept.	21,945	20,012	17.8	....	36,067

Source: U. S. Department of Commerce.
Notes: (1) These figures are revised from time to time and the latest available issue should be consulted for the most accurate data. (a) Includes natural and synthetic rubber. (b) Includes 893 tons of imports. (c) Includes 67 tons of imports. (d) Includes 21 tons of imports.

Cotton, Rayon and Nylon Tire Fabrics

(In Thousands of Pounds)

	Production: Rayon Tire Cord Not Woven	Production: Rayon Tire Cord Woven	Production: Cotton and Nylon Cord & Fabric[a]	Production: Chafer Fabrics (all fibers)	Production: Total Tire Cord and Fabric	Stocks[b]: Cotton and Nylon Cord & Fabric	Stocks[b]: Rayon Cord and Fabric
1955:							
Jan.-Mar.	20,299	79,191	14,870	12,763	127,123	6,863	44,239
Apr.-June	21,550	81,036	18,898	12,724	134,208	8,870	40,689
July-Sept.	20,740	81,996	16,093	12,941	131,770	9,679	47,272
Oct.-Dec.	24,343	77,600	15,754	12,333	130,030	9,182	46,636
Total	86,932	319,823	65,615	50,761	523,131	34,594	178,836
1956:							
Jan.-Mar.	23,707	74,883	16,085	12,815	127,490	10,185	48,936
Apr.-June	21,557	60,644	13,776	10,511	106,488	9,576	41,630
July-Sept.	.....	.....	.....	.....	.....	.....	.....
Oct.-Dec.	.....	.....	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....	.....

Source: Bureau of the Census, U. S. Department of Commerce.
Notes: (a) Combined to avoid disclosing figures for individual companies. (b) At end of period.

Gasoline Consumption

(In Thousands of Barrels of 42 Gallons)

	1950	1951	1952	1953	1954	1955	1956
Jan.	66,981	80,670	86,863	89,634	89,852	96,397	100,642
Feb.	53,274	72,864	82,043	86,458	86,206	88,464	98,088
Mar.	78,780	86,962	87,065	98,158	101,549	105,684	113,128
Apr.	80,350	87,573	98,563	102,044	103,866	111,116	113,034
May	89,035	100,266	101,137	105,918	104,418	115,707	124,114
June	90,174	96,364	99,305	114,703	113,037	120,710	127,413
July	91,677	100,567	105,307	112,960	112,231	115,653	120,987
Aug.	94,507	101,453	102,954	109,124	110,223	121,816	.....
Sept.	86,725	91,891	100,095	106,158	104,706	113,379	.....
Oct.	89,067	100,209	103,689	106,037	105,607	112,558	.....
Nov.	82,688	88,581	91,326	99,210	102,393	109,212	.....
Dec.	81,032	84,551	95,817	100,225	104,258	111,034	.....
Total	994,290	1,091,951	1,154,254	1,230,629	1,238,346	1,321,730	.....

Source: U. S. Bureau of Mines.

U. S. Gross Imports of Balata, Jelutong, Gutta-Percha, etc.

(All Quantities in Long Tons)

Year	Balata: Tons	Balata: Value	Jelutong: Tons	Jelutong: Value	Gutta-Percha & Other Guttas: Tons	Gutta-Percha & Other Guttas: Value
1944	1,012	$660,805	88	$45,578	10	$4,999
1945	1,361	907,253	....	.....	36	21,970
1946	2,281	2,233,065	304	256,169	423	458,064
1947	1,982	2,276,531	2,878	1,496,887	392	779,591
1948	1,195	805,078	3,401	2,377,765	423	542,788
1949	1,391	814,554	1,043	834,978	197	189,021
1950	2,117	1,589,885	1,789	1,515,162	541	745,418
1951	2,452	1,973,271	1,669	2,608,359	383	430,539
1952	988	762,994	1,636	2,094,983	282	385,890
1953	1,619	866,248	1,027	1,166,837	235	303,116
1954	949	504,065	2,196	2,624,926	417	511,055
1955	1,022	967,369	1,679	1,731,821	284	318,115
1955:						
Sept.	151	181,535	97	105,884	10	9,295
Oct.	261	254,853	206	213,394	8	12,039
Nov.	11	94,967	97	97,981	12	21,302
Dec.	66	51,938	138	114,286	5	3,318
1956:						
Jan.	49	30,670	112	99,777	9	18,066
Feb.	68	57,777	140	137,190	11	13,642
Mar.	164	116,302	135	123,366	17	21,620
Apr.	93	62,425	111	105,593	34	48,766
May	31	22,595	152	159,121	33	34,803
June	99	78,150	248	243,307	15	14,008
July	46	53,177	147	152,950	13	31,774

Source: U. S. Department of Commerce.

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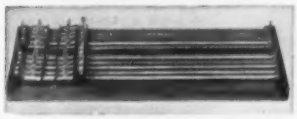

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4 oz. Crown Moldmaster complete fully automatic.
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8 oz. Reed-Prentice double toggle.
8 oz. Impco mdl. VF-8, compress & transf. features, extra 12 oz. cyl.
9 oz. HPM 200 ton fully automatic.
16 oz. Reed-Prentice No. 10-E-16, electric heated, 1948.
22 oz. Impco, model VF-8-22.
24 oz. DeMattia model B, inspect in operation.

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2 ton Denison 3 HP MD.
5 ton Logan, twin ram 7½ HP, MD.
15 ton Stokes No. 200D-2 automatic (10).
15 ton Consolidated self-contained.
20 ton Elmes No. 3429P laboratory, electrically heated platens 8" x 8".
25 ton Consolidated 24" x 30" self-contained pump & motor.
30 ton Watson-Stillman laboratory, platens 8" x 5" (2).
30 ton Watson-Stillman 4½" ram x 18" stroke 12½ LR-16" F-B 22" DLO MD.
30 ton Baker, full automatic model 958, excellent condition, new 1951.
30 ton HPM upmoving 12" x 12" platen 12" DLO 12" str. with controls.
35 ton HPM down-acting, ram 6" x 6" str., bed 12" x 6", DLO 15", self-cont.
40 ton Francis, 4 opening, 12" x 12" elec. heated platens.
40 ton Loomis, 4 opening, 12" x 12" elec. heated platens, MD self-cont.
50 ton Baldwin-Southwark angle molding press, practically new.
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50 ton Watson-Stillman, 12" x 12" elec. htd. platens, MD pump.
60 ton Weaver bet. housings 42".
60 ton Elmes hydr. straightening press.
75 ton Farquhar, upacting, 30" x 42" platens.
100 ton Farquhar drawing, stroke 36", hi-speed appr., press, return.
100 ton Farquhar, self-cont., down-acting ram 11" x 26" str., 30" x 28".
100 ton Stokes standard semi-automatic power system timing controls.
100 ton Watson-Stillman, platens 13" x 13", ram 8½" x 3" str., MD pump.
100 ton HPM 72" STR platen 30" x 30", 84" DLO fast acting.
100 ton Watson-Stillman, 4-post, platens 11¾" x 12", ram 8" x 15" stroke.
100 ton Watson-Stillman, bed 22" x 20", DLO 24", self-cont.
100 ton Lake Erie hi-speed, 24" x 24" bed, 12" DLO, self-cont.
113 ton French Oil Mill, 6 opening elec. htd. platens 15" x 18".
113 ton R. D. Wood, 5 opening elec. htd. platens 14" x 20".
113 ton Stewart Bolling 20" x 20" steam platens 12" upmoving ram x 14" STR.
150 ton Stokes standard semi-automatic power system timing controls.
215 ton Lake Erie self-cont. semi-auto., bed 36" x 36".
150 ton Carey, platens 20" x 16" adj., DLO 8"-28".
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Model 61, KUX, 30 ton single punch.
No. 2 RP Colton, 16 punch, rotary, motor drive, 1½ HP.
No. 3 RP Colton, 16 punch, rotary, motor drive, 1½ HP.
No. 3 DT Colton 25 ton, single punch.
No. 2806 Stokes, single punch, dual pressure.
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No. 5 Arthur Colton, motor drive, 3 HP.
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No. DDS-2 Stokes, 23 stations, US vari-drive, 10 HP.
No. DD-2 Stokes, 23 stations, Reeves vari-speed drive, 7½ HP.
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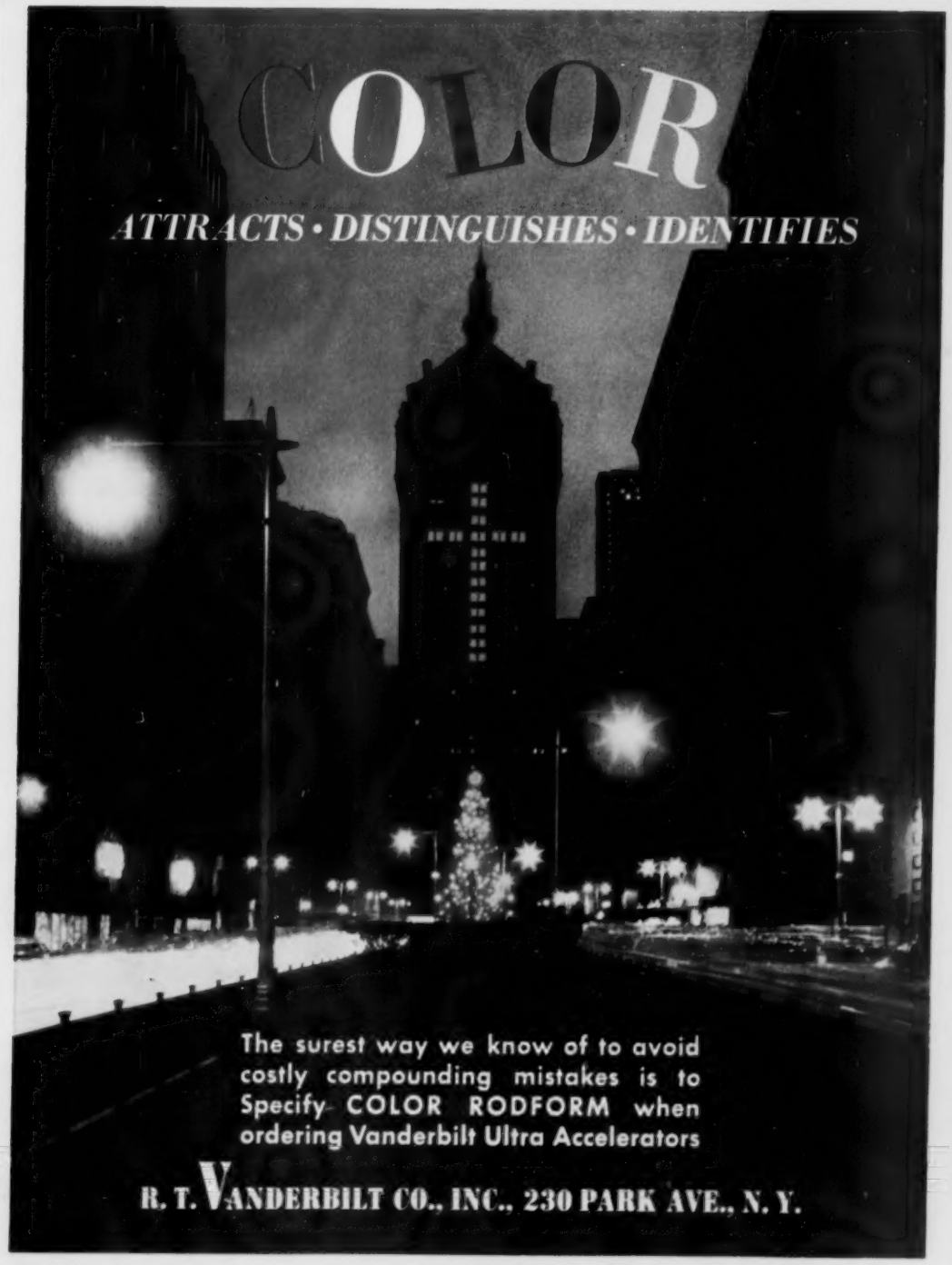
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